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Concrete

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1929 Progress in Concrete Pavement Construction

New Mileage of Concrete Roads is About Equal to Last Year's Work — Street Pavement Construction Holds Pace—Airport Pavement Shows Big Increase—Great Strides Made in Quality of Street Pavements—Some Increase in Volume Expected for 1930

DURING 1929, concrete road and street construction maintained the record-breaking volume established last year. In road building, that year's efforts will add approximately 8,500 miles of new concrete highway to the nation's traffic ways. Nearly 50,000,000 square yards of municipal awards paved city streets from Maine to California and from Washington to Florida.

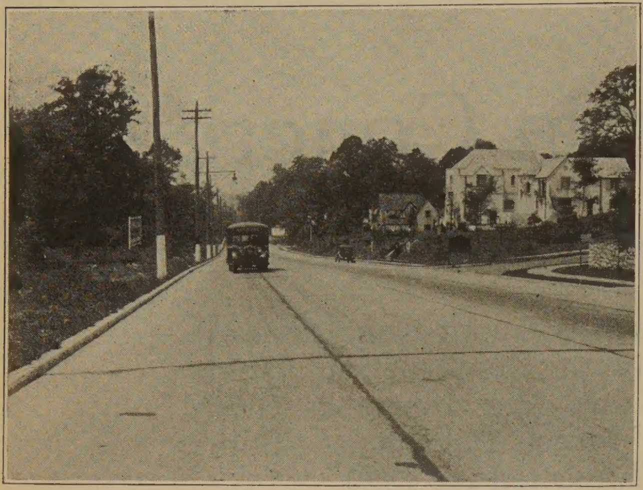
Volume alone is not an indication of outstanding accomplishment. In quality of construction, too, progress has been made. Both for work under the jurisdiction of state highway departments and city street improvement departments have construction practices improved. State highway work, generally has been of superior quality for some years, but in the field of street pavement, taking the country as a whole, there has been very definite improvement in construction practices.

Highway Awards

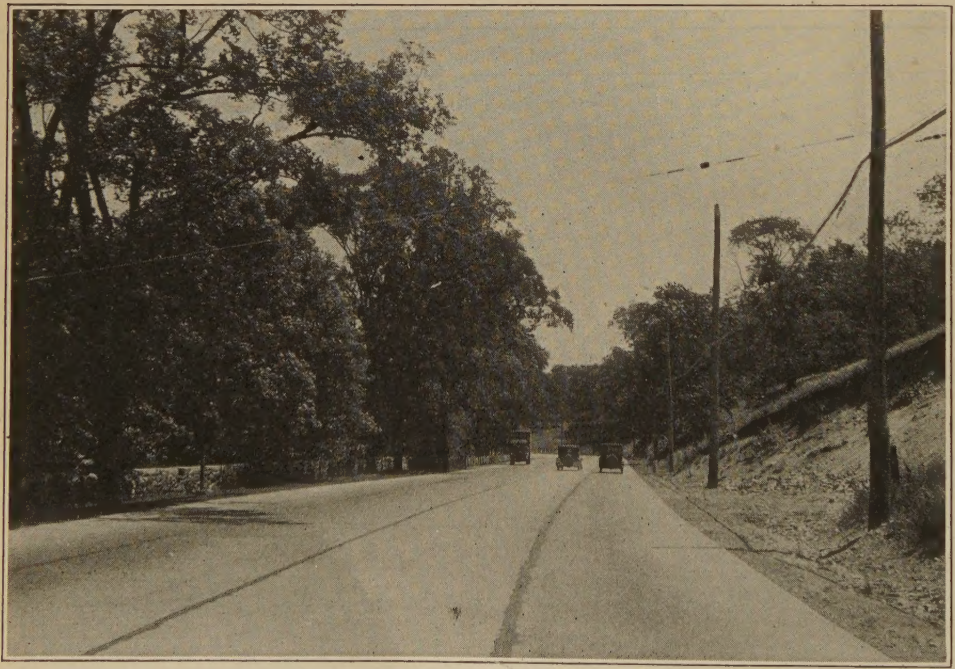
While final figures on concrete highway awards are not yet available, the indications are that the 1929 awards will very nearly equal the 1928 awards—a volume of approximately 90,000,000 square yards. Several million square

Second Avenue, Seattle, Wash., a big city street paved with concrete during 1929 yards of road pavement awards are pending in several states and the final disposition of these contracts will be the deciding factor in determining a slight increase or a slight decrease in the total highway yardage awarded.

This record for 1929 is the more remarkable when it is realized that Illinois—for many years one of the banner states in highway mileage—was unable to contribute its normal quota this past year because of the fact that the gas tax funds for road improvement were tied up in the courts. This does not mean that Illinois has abandoned its road program or that it has decided on smaller yearly programs. An unfortunate condition simply prevented the continuation of road construction at the previous year's pace. During 1928, Illinois awarded over 15,500,000 square yards of concrete pavement. During 1929, the total pavement awards were approximately 4,000,000 square yards. Because many of the 1928 awards were held over for construction in 1929, the state of Illinois will actually have built approximately 750 miles of pavement during 1929.



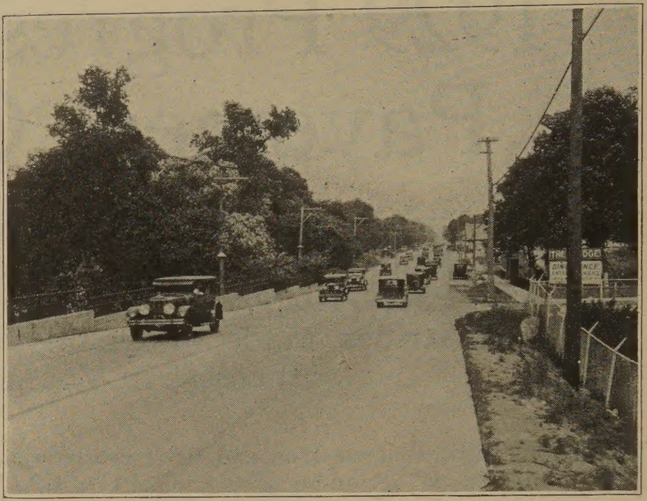
A 1929 Philadelphia pavement



A 1929 model highway in Westchester County, N. Y.

Other States Increase Volume

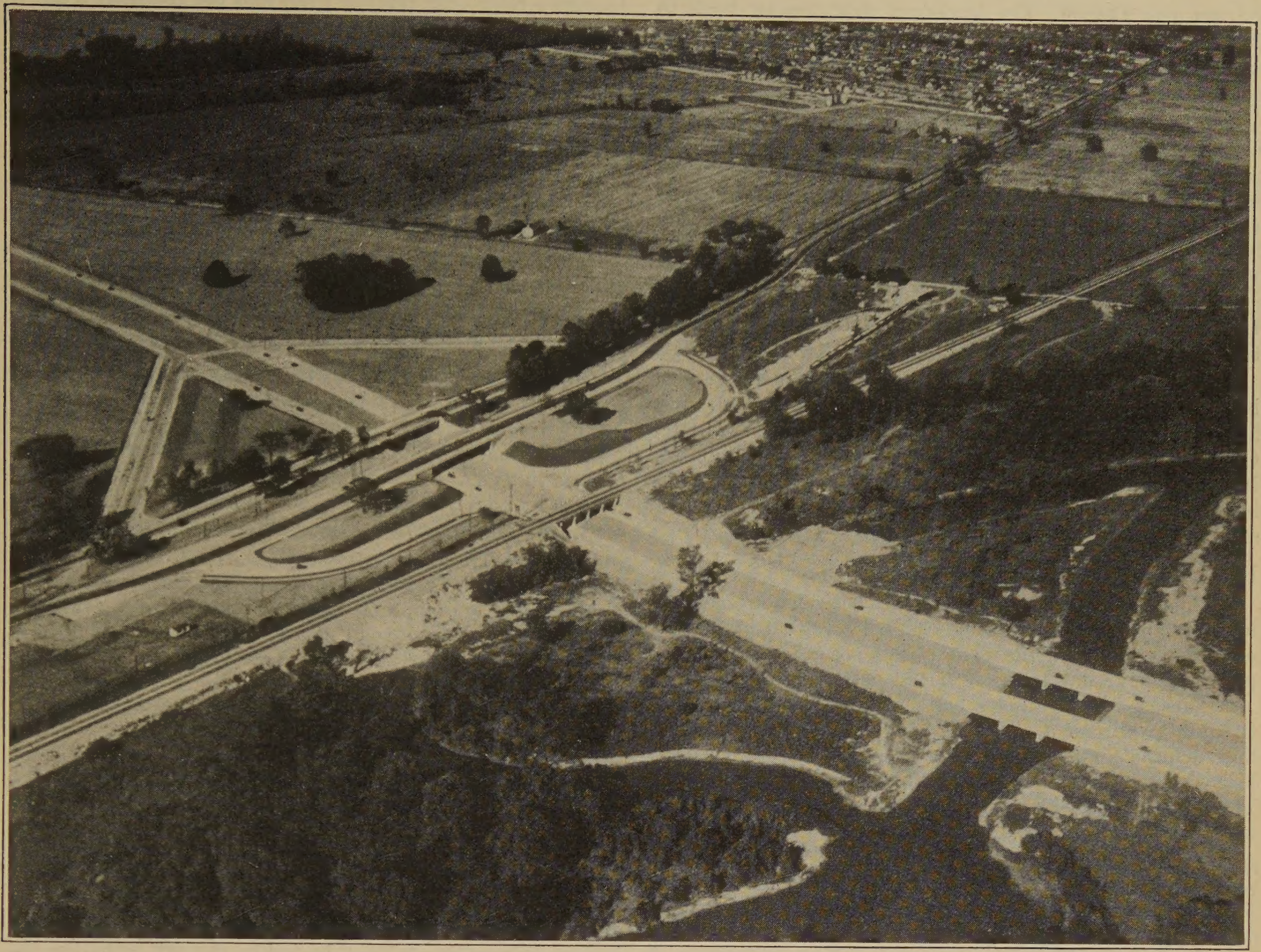
The deficiency caused by the lower awards in Illinois was compensated for by increased awards in other states. No one section of the country contributed outstandingly to this deficit, the increase being fairly well distributed throughout the country.



A 40 ft. pavement in Cook County, Ill.

Some few states made outstanding progress during 1929.

Louisiana, which awarded only 30 miles of concrete pavement in 1928, rolls up a total of 300 miles in 1929. New Hampshire, with approximately 60 miles of awards in 1929, doubled its 1928 quota. Texas, with 700 miles awarded in 1929, increased its 1928 awards by approximately 125 miles. Indiana shows a 100-mile gain, bringing its total 1929 awards to 500 miles. Missouri, with

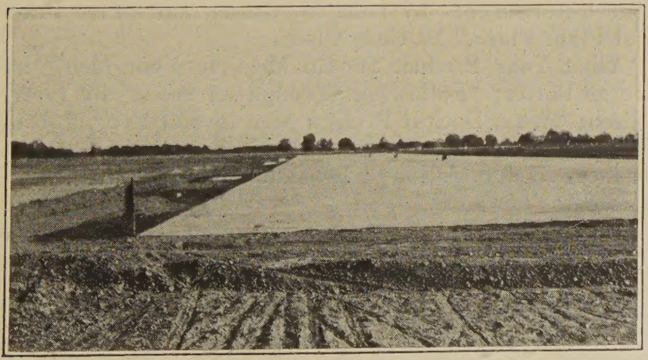


A bird's-eye view of the Southfield grade separation in Wayne County, Mich., an example of the highest development in modern road construction

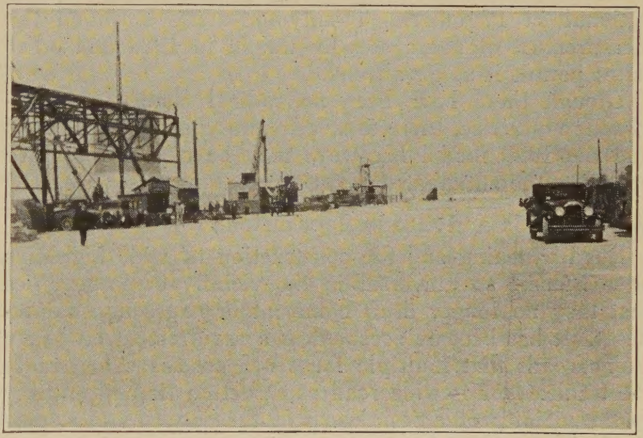
600 miles for 1929, steps up its awards around 450 miles over last year. Minnesota showed an increase of approximately 50 per cent in the volume of its concrete pavement awards.

With incomplete statistics available and with variations in widths of roads constructed, it is difficult to group the states according to their awards. The following states, approximately in the order named, contributed most to the 1929 total, with mileages ranging between 800 and 600: New York, Michigan, Texas, Iowa, Missouri, Pennsylvania.

Street paving awards closely approximate last year's volume—approximately 50,000,000 square yards. Distribution of awards, also, is much the same, cities having concrete paving programs last year continuing in approximately equal volume.



A completed concrete runway at Wayne, Mich.



The concrete apron constructed at the Detroit Municipal airport during 1929

Airport Pavements

In no field of concrete pavement construction has the percentage of increase in yardage been as great as in the building of airport pavement. There are now more than twenty concrete runways either in service or under construction.

The pioneer in concrete runway construction is the Ford airport near Detroit. The success of this runway, built in 1928, has led to the construction of two more similar runways at the same port in 1929 and has stimulated similar construction at other airports.

The second airport to build concrete runways was the Grand Central airport at Glendale, Calif. This was completed in January, 1929. Other concrete runways were built during 1929 at the New York City Municipal airport (Floyd Bennett Field), the Detroit Municipal airport, the St. Louis Municipal airport and the Wayne County (Mich.) airport. Construction has already begun on concrete runways for the Curtis-Wright airport at East St. Louis and several others are planned for 1930 construction.

A considerable amount of concrete pavement has also been placed at various airports in large aprons around hangars and taxi-ways for planes and motor vehicles. Concrete construction is also preeminent for airport buildings, it being estimated that approximately 1,000,000 barrels of cement were consumed in 1929 for airport construction.

Road Construction Developments

Comparatively few changes have been made in state highway specifications during 1929. Those that have been made have extended the proven better construction practices that have developed over the past few years.

Arkansas, Massachusetts and Tennessee have added a strength requirement. There are now a total of 13 states that definitely specify that the concrete placed on their highways attain a certain specified strength at 28 days. Three more states have incorporated clauses limiting the amount of mixing water—Arkansas and Alabama 5½ gallons of water per sack of cement and Wisconsin six gallons. Seventeen states now limit the water content and a total of 24 states either have a strength requirement or a mixing water limitation.

Only 7 of the 48 states now use a uniform thickness of slab, two more states having adopted a thickened edge section during 1929.

Machine finishing is now required in 26 states and is optional in 17 others. Twenty-one states specified the measurement of aggregates by weight in 1929 and other states permit it as an alternate.

Though there have been no radical changes in construction practice, there is steady and consistent progress and the 1929 model highways may be expected to give motorists the anticipated years of economical service.

Wide Roads and Grade Separations

Road widening and the construction of wide highways have become so universal in the vicinity of large cities that they no longer draw comment or cause unusual interest. It has become accepted as a requirement on heavy traffic roads that multiple lanes are necessary to handle the traffic. Nor is wide road construction limited entirely to the vicinity of cities. Some of the eastern states, particularly New York, are extending their multiple lane roads far out into the country.

The past year has seen considerable activity in grade crossing elimination, both at railroad crossings and main highway crossings. The strong recommendations of the U. S. Bureau of Public Roads in this regard are beginning to bear fruit in many states. Illinois is one of the states that has set aside a portion of its gas-tax funds for that purpose.

Interest is beginning to center around the possibility of constructing express highways connecting important cities. Several plans in which the work is to be undertaken under federal sanction are already proposed. At least two bills—the Harlow Plan and the Holliday Plan—have been presented before Congress. The general purposes of the two bills are much alike, though one proposes to raise funds by levying toll, while the other is to be financed through a gas tax.

Street Pavement Progress

Street pavement construction has not been as well standardized as highway construction has become under the helpful influence of the U. S. Bureau of Public Roads. The past few years have called attention to the need for more rapid progress in this important branch of the paving industry with the result that street construction practice is steadily improving.

What's Ahead for 1930?

Indications from various sources are that pavement builders may expect to see the coming year bring at least as great activity in both road and street construction as in 1929. Some reliable surveys, notably that conducted by the United States government, indicate an increase of 10 per cent in the volume of pavement to be placed in 1930.

There are bills before Congress to increase Federal Aid to the states and there is slightly more money available in state and county road bonds than was available in 1929. Only in a very few states are there any indications of a reduction in road building volume and these are more than offset by increased programs in other states.

Wisconsin Products Program Features Short Talks

Judging from an outline of the program scheduled for its forthcoming meeting, the Wisconsin Concrete Products Association will uphold its reputation for making attendance well worth while. Products men of all states are invited to participate in this eighth annual gathering, to be held at the Hotel Plankinton, Milwaukee, Wisconsin, January 29th and 30th.

Briefly, the program will be as follows:

Wednesday, January 29th—Registration and getting acquainted; formal reports; five-minute talks by district representatives on "My Outstanding Job and How I Landed It."

"The Ten Commanding Jobs," by W. D. M. Allan and Ted Merriam, both of the Portland Cement Association, followed by discussion.

Thursday, January 30th—"Manufacture and Sale of Concrete Products," a series of 10-minute papers on problems that enter into the manufacture and selling of various concrete products; "Saving Dollars with Sense" by I. J. Westerveld; "Swapping Old for New—At a Profit," by Charles Van Houten; "Putting Responsibility in Place," by W. C. Muehlstein; "This Business of Building Code Enforcement" by Leon M. Gurda, and "Five Practical Plant Plans," by Gene Olsen.

"What Your Product Should Mean to Your Men," by George Porter; "Following Through on Sales," by F. W. Zilisch; "What Does It Profit a Man to Sell Every Job in Town and Then Lose His Shirt?" by Harry Colman. Business session, followed by annual banquet and entertainment.

Crushed Stone Meeting

The thirteenth annual convention of the National Crushed Stone Association is scheduled to be held at the Hotel Gibson, Cincinnati, Ohio, on January 20th to 22nd.

How to Save in Concrete Form Work

Many large construction companies have been very successful in determining the best concrete form work practices and in solving detail problems. Contractors who engage in concrete work on a smaller scale, however, do not generally have as reliable information with which to solve form work problems or the resources for gathering the data. Many contractors do not employ the most economical methods either in form erection or removal. Much form lumber is unnecessarily "butchered." As a result the actual cost of form work is often considerably more than it should be.

Form work economy and details are the two most important angles which A. B. MacMillan deals with in the series of articles, "How to Save in Concrete Form Work," the first of which begins in this issue. Mr. MacMillan has had years of experience in concrete construction and will cover a wide range of form problems.—Editor.

I—Footings and Foundation Walls

By A. B. MacMILLAN
Chief Engineer, The Aberthaw Company, Boston, Mass.

MOST contractors build plain or lightly reinforced concrete work on almost every contract. The occasional contract for a fireproof school building or hospital bring them into the less familiar field of heavily reinforced concrete construction. It is the writer's hope that these articles, giving details and descriptions of form work for various parts of buildings, will bring to the general building contractor and the masonry sub-contractor a more definite knowledge of form economy. While many of the details to be given represent the practice of the organization with which the writer is connected, much material will be taken from other sources.

Fundamental Requirements

It is well to point out at this time some of the fundamental principles to be observed in concrete form work. In general, the most important points to be remembered are the following:

1. The forms must be rigidly braced and shored to prevent collapse.
2. The timber used must be heavy enough or braced at sufficiently frequent intervals to prevent springing or bulging.
3. The weight should be as light as is consistent with strength and rigidity.
4. Forms must be tight enough to prevent serious loss of mortar and to prevent formation of fins on the surface of the hardened concrete where mortar has run between loosely fitting boards.
5. Details of form work should be so devised as to simplify both the erection and removal of forms and to permit individual form units to be used over and over again.
6. The size and weight of individual form units should not be greater than may be handled by the number of men in the form work crew. It is best not to exceed a 2-man load of 150 pounds.

Quality of Form Lumber

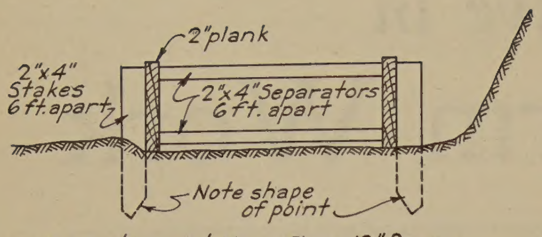
The quality of lumber used in form work will depend in part upon the location of the work within the structure. Usually wall footings and column footings are completely covered over, so that scrap form lumber may be employed. On the other hand, work that will be exposed in the finished structure should have its form work made of lumber of a good quality. Boards which later may be used as sub-flooring, roof sheathing, or wall sheathing are most commonly used in form work.

In special cases where the surface finish is to be left untouched after the forms are stripped, it will, of course, be necessary to use dressed lumber, together with the necessary moldings, to obtain the effects desired.

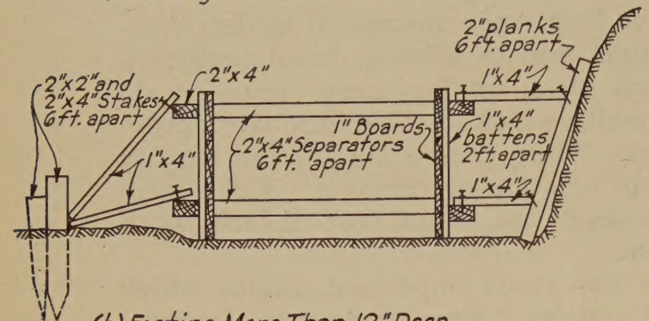
Pressure on Forms from Fresh Concrete. Tests we have made and the results of field experience show that the pressure against forms should be figured on the basis that the fresh concrete is a liquid weighing 145 pounds per cubic foot. This pressure continues to build up as additional fresh concrete is added, until a time period of approximately 30 minutes has elapsed. After this time there seems to be no further increase in the maximum pressure. Obviously, the strength of cleats, boards, ties and other parts of forms for walls and columns must be considered in relation to the depth of concrete likely to be placed in 30 minutes.

Concrete placed during cold weather will, unless the construction is inclosed and kept warm, continue to build up pressure for a period considerably longer than 30 minutes.

Caution About Placing Concrete. The method of plac-



(a) Footing Not More Than 12" Deep


2" planks 6 ft. apart
2"x2" and 2"x4" Stakes 6 ft. apart
2"x4"
1"x4"
1" Boards
2"x4" Separators 6 ft. apart
1"x4" battens 2 ft. apart
1"x4"
1"x4"

(b) Footing More Than 12" Deep

FIGURE 1-BRACING FORMS FOR WALL FOOTINGS

ing concrete must be such as to avoid shock. Any scheme which allows a large mass to drop suddenly to the bottom of the forms may cause serious distortion or even collapse of form work.

Form Nails and Other Specialties

Both the erection and the removal of forms will be greatly simplified by the use of special double-headed form nails, screws, tie bolts, wire ties, and clamps. In this way the form work employed in one set of footings, floor panels or columns, for illustration, may be removed with the least possible damage and used over and over again in other parts of the structure.

Double-headed form nails may be obtained in all sizes from 6-penny to 30-penny. If local material dealers do not handle them, the contractor may obtain them direct from the manufacturer.

Footings

Wall Footings. Wall footings are usually of rectangular cross section, so that the erection of form work for them is a simple matter. When the footing is much wider than the wall, it usually becomes necessary to step the footing or else to reinforce it with steel.

The details for the form work for a single box column footing shown in Figure 2 will suggest similar details for the single-step wall footing. The forms may be braced and tied in a similar manner with separators and twisted wires.

It will therefore be sufficient to show other ways of bracing forms for single-step wall footings, by the methods illustrated in Figure 1.

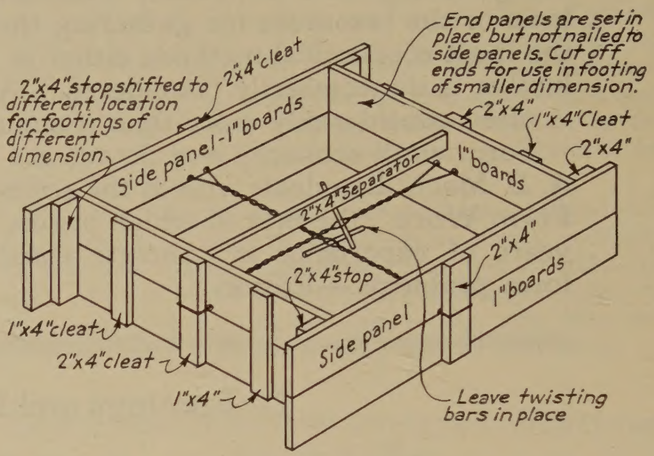
Column Footings. As a general thing, column footings are one of three types, namely, the ordinary square or rectangular box footings, the stepped footing, or the sloped footing. Each of these types will be discussed and illustrated.

Firm Earth as Form for Concrete. In many cases where the ground is hard and firm the sides of the hole dug for the footing will act as the form. The holes must be dug carefully to the required dimensions with the sides even and vertical and with the bottom leveled at the proper depth. This constitutes the most economical form work.

Sheeting as Form Work. If the ground is soft, so that the excavation must be sheeted, the sheeting may likewise be employed as the form work for footings. The superintendent of construction should not overlook this opportunity to get double duty out of sheeting wherever possible.

Box Footings. The form work for a box footing is a simple open frame or bottomless box designed to be removed easily and used over again. If the column footings are of different sizes, as they nearly always are, the box form should be built so as to permit adjustment of dimensions without requiring the complete "knocking down" of the form.

Figure 2 shows the details of forms for a single box column footing. Notes indicate the adjustments that may be made for variation in footing dimensions, so that the same set of forms may be used for a number of different footings. The form panels should be used on the largest footings first, then cut off as may be necessary for the next smaller size. Note, also, the method employed in holding the forms in place with wire ties and separators. In some instances it may be convenient to brace the column footing forms in a manner similar to forms for wall footings, as shown in Figure 1. In a column footing this bracing is required against the side form panels only.


End panels are set in place but not nailed to side panels. Cut off ends for use in footing of smaller dimension.
2"x4" cleat
2"x4" stop shifted to different location for footings of different dimension
Side panel-1" boards
2"x4"
1"x4" Cleat
2"x4"
1" boards
2"x4" Separator
2"x4" stop
2"x4"
1" boards
Side panel
1"x4" cleat
2"x4" cleat
1"x4"
Leave twisting bars in place

DETAIL OF FORM PANELS IN PLACE, TIED WITH TWISTED WIRES

FIGURE 2-FORMS FOR BOX FOOTING

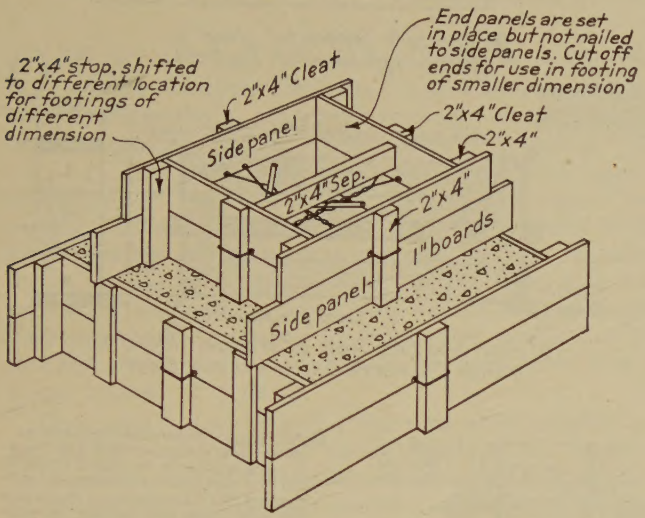
Stepped Footings. The form work for a stepped column footing is a repetition of that for a single box footing. As soon as the concrete in the lower box has attained its initial set the box for the second layer may be placed as shown in Figure 3.

It is possible to set the form work for the upper step at the same time as that of the lower step by extending the lowest board of each side panel far enough to have it rest on the edges of the lower box, as shown in Figure 3. It is only on special occasions that this will be desirable, because the upper box will interfere with placing the concrete in the lower. It is necessary, even in this case, to stop the concreting when the lower box is filled, giving the concrete time to attain its initial set before filling the upper box.

Sloped Footings. Both the form work and the concreting of sloped footings are troublesome and should be avoided wherever possible. Even when the footings have been designed with sloped tops the contractor may often obtain permission to substitute a stepped footing which at no point has less depth than the sloped footing shown on the plans. This is shown diagrammatically in Figure 4, which illustrates the manner in which a sloped footing may be converted into a stepped footing. Even though this change involves the placing of more concrete, the cost of the additional material is more than offset by the more simple form work and the greater convenience in placing the concrete.

When the engineer-in-charge or the architect's superintendent insists on having a sloped footing put in, as shown on plans, there is, of course, no choice in the matter.

Figure 5 shows the details of the form work for a square-based sloped footing. That part of the footing which has vertical sides should first be concreted, with form work, the same as shown in Figure 2, for an ordinary single box footing. The four sloping side pieces, or panels, are then assembled, as shown in Figure 6, the side panels being fastened to the end panels with lag screws. The length of a screw must be about 5 inches, since it is required to penetrate an inch board, the 2-by-4 batten on the side panel and part way into the batten on the end panel. Holes must be drilled for the screws in advance of assembling the forms.


End panels are set in place but not nailed to side panels. Cut off ends for use in footing of smaller dimension
2"x4" stop, shifted to different location for footings of different dimension
2"x4" cleat
Side panel
2"x4" Sep.
2"x4" Cleat
2"x4"
2"x4"
1" boards
Side panel

Form Panels in Place for Upper Step After Lower Step is Concreted – Braced with Separators and Twisted Wires

Figure 3 – Forms for Stepped Footing

The dimensions of the form panels shown in Figure 5 must be obtained from the dimensions of the footing. The upper and lower edges of an end panel have, of course, the same widths as the top and bottom edges of the footing. The height of the end and side panels may be determined by laying off the height of the sloped part of the footing as the "rise," while the "run" is half the difference between the top and bottom dimensions of the footing. The height of the panel, when held upright, will of course be equal to the length of the slope as determined from the "rise" and "run."

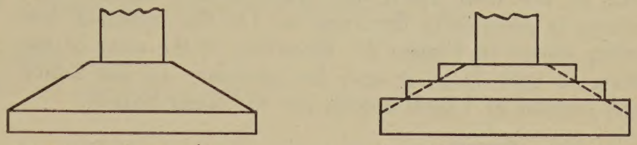

(a) Sloped Footing (b) Stepped Footing

Figure 4 – Sloped Footing Converted into Stepped Footing of Equal Strength, to Simplify Form Work

The end form panels must have exactly the same dimensions as the sloping face of the footing, since the side panels are to rest against them. All battens on end panels are on the outside.

The side form panels have the middle batten on the outside. The end battens are on the inner side and are placed so that the clear space between them, at both top and bottom, is 1¾ inches greater than the corresponding footing dimensions. This additional distance of 1¾ inches represents twice the actual thickness of the 1-inch boards, and permits the end battens of the side panels to fit over the outside of the 1-inch boards of the end panels.

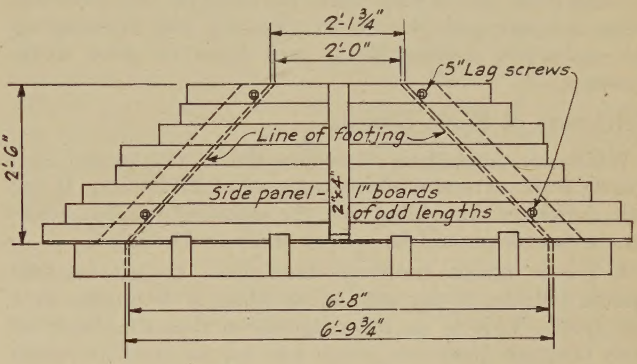
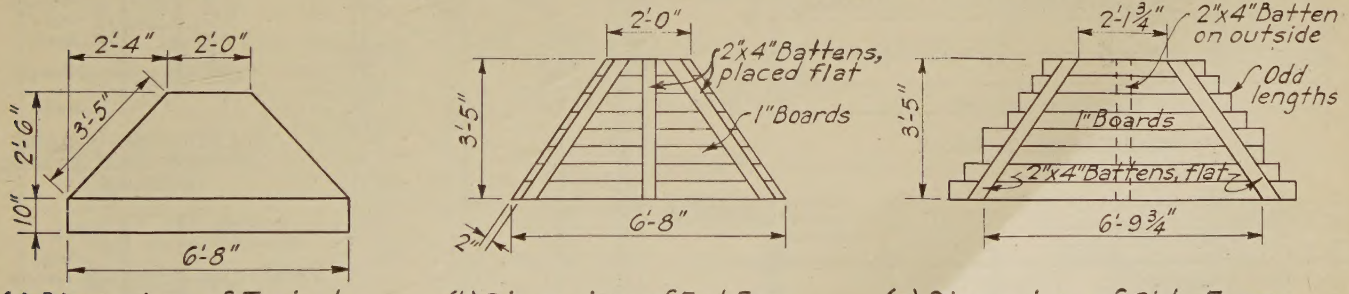


Figure 6 – Side View of Assembled Forms for Sloped Footing



(a) Dimensions of Typical Square Concrete Footing

(b) Dimensions of End Form Panels for Sloping Part of Footing – View From Outside

(c) Dimensions of Side Form Panels, for Sloping Part of Footing – View From Inside

Notes:–
(1) End form panels have exactly the same dimensions as the sloping face of the completed footing.
(2) Side form panels have end battens on inner side, but placed so as to fit over outside of 1" boards of end panels.

Figure 5 – Details of Form Panels for Sloped Footing

Spread Footings. The term "spread footings" is here employed to designate footings consisting essentially of reinforced concrete slabs or mats, and whose area or width is much greater than the area of the column pedestal or width of the wall above it. The form work for such footings is essentially the same as for the ordinary box footing shown in Figure 2. However, if the area of the footing is very large it may be necessary to use 2-inch plank instead of 1-inch boards for the form boards.

Foundation Walls

The form work for foundation walls must be rigidly braced so as to permit the placing of the concrete in one continuous operation. Considerable pressure is exerted against the forms when the fresh concrete above that which has partially set is several feet deep. Concrete weighs approximately 145 pounds per cubic foot, so that the pressure will be more than may at times be realized. The form boards must be supported at intervals close enough to prevent springing or bulging between the uprights.

Wall forms must be sufficiently tight to prevent leakage of mortar, for the reason that such leakage often results in porous strips or patches of concrete, as well as the formation of fins which must be chipped off after the forms are stripped. Excessive patching and dressing up are expensive, besides being sure signs of poor workmanship.

Thickness of Form Boards

Walls not more than 12 inches thick may have 1-inch boards with vertical studding spaced at 27 inches. If the wall is thicker than 12 inches, the studding for this thickness of boards should be spaced at 20 to 24 inches.

A 2-inch plank (nominal thickness) should be safe against bulging if the vertical studding is 40 inches to 4 feet apart. This is on the supposition that the depth of fresh concrete (concrete which has not attained its initial set) is not more than 3 feet.

Assembly by Panels

The form work for foundation walls, as well as all other form work, may be assembled by panels in order to simplify erection and removal. The connections between panels should be such that the panels may be removed without being damaged, and used over again. Details of such panels are illustrated in Figure 7. The weight of a panel should not exceed 150 pounds, so that a unit may be handled by two men.

Time to Strip Wall Forms. Wall forms should ordinarily not be stripped in less than 48 hours after the concrete is placed. During cold weather or when working under high speed, wall forms must remain in place for a longer period.

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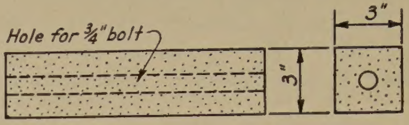
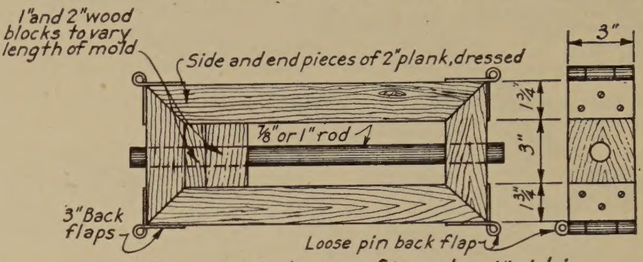
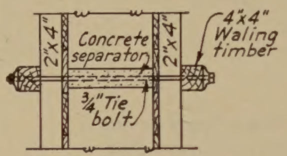


(a) Concrete Separator Used in Combination with Tie Bolt.


1" and 2" wood blocks to vary length of mold
Side and end pieces of 2" plank, dressed
3"
⅞" or 1" rod
1¼"
3"
1¼"
3" Back flaps
Loose pin back flap

(b) Plan and End View of Wooden Mold in Which Concrete Separator is Cast.

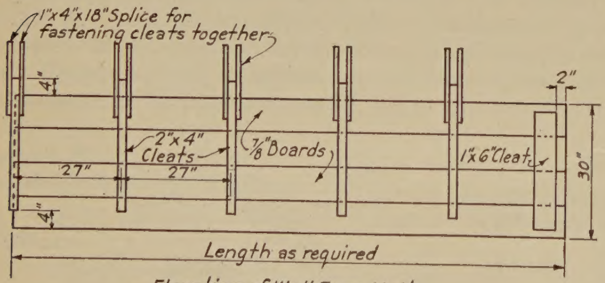


(c) Detail Showing Manner of Using Separator and Tie Bolt

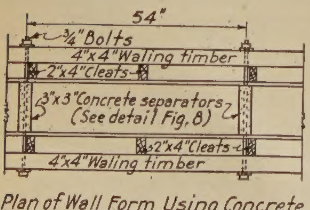
DIRECTIONS:- Assemble the mold as shown in the plan, with a ⅞" or 1" rod in place, and set it on a piece of plank. Fill the mold with a 1:3 mortar of rather stiff consistency, tamp and level off. Draw the rod out, remove the loose pin from the back flap and remove the mold.

Note:- For use of separator see FIGURE 7.

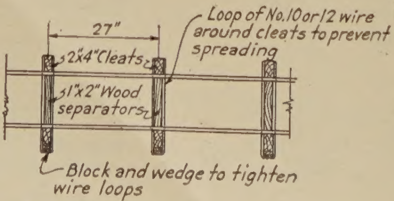
FIGURE 8 - DETAIL OF CONCRETE SEPARATOR



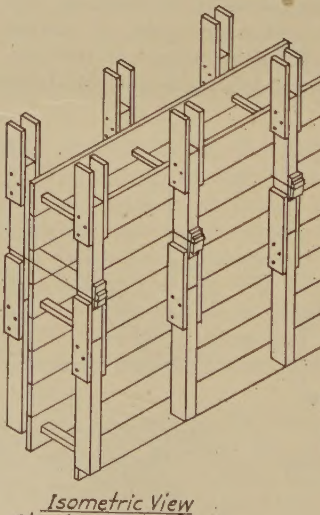
Elevation of Wall Form Unit



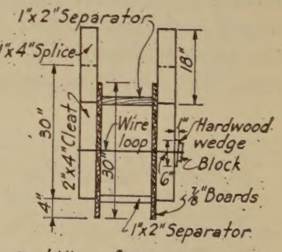
Plan of Wall Form Using Concrete Separators, Waling Strips & Tie Bolts


Loop of No. 10 or 12 wire around cleats to prevent spreading
27"
2"x4" Cleats
1"x2" Wood separators
Block and wedge to tighten wire loops

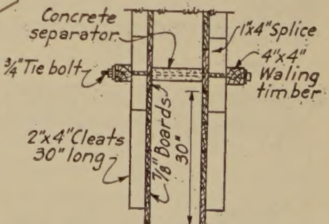
Plan of Wall Form Using Wire Loops To Prevent Spreading



Isometric View Showing 2 Tiers of Wall Form Units Assembled



End View of Wall Form Unit Showing Method of Tightening Wire Loop



End View of Wall Form Units Showing Use of Tie Bolts and Concrete Separator

FIGURE 7 - DETAILS OF WALL FORMS WITHOUT EXTERIOR BRACING

Collecting a Million Dollars

How the Milwaukee Concrete Products Cooperative Association Handles Its Credits and Collections

By "SPEC" COLLINS

Manager, Milwaukee Concrete Products Co-operative Association

ONE day not long before the formation of the Milwaukee Concrete Products Co-operative Association one of Milwaukee's prominent concrete block manufacturers made the remark, "Our company is called "The ____________ Block Company," but I guess we'll have to change it to "The ____________ Block & Finance Company." This man was in exactly the same situation as the great majority of Milwaukee concrete products manufacturers. In the mad scramble for business they had been selling anyone and everyone who wanted to buy blocks. Salesmen, in their anxiety to make sales, overlooked the fact that a sale easily made would, in many cases, lead to a loss instead of a profit.

They were in fact financing many an undependable and unreliable contractor who could obtain credit nowhere else and because of his business experience and methods of conducting his business merited credit from no one. These accounts were given very little investigation by the men that were doing the selling. The fact that a man had been buying blocks from a competitor seemed to be the guiding factor in extending him credit. Every one was hungry for business, and more business. Every one gloated over "taking away" the customer of a rival manufacturer. And when this "taking" was done, the man doing it seldom or ever made an investigation to see whether or not he was justified in extending credit to the new account he has just landed. Calling the block manufacturer where his customer had bought previously was the last thing he ever considered.

Harm Follows Promiscuous Credit

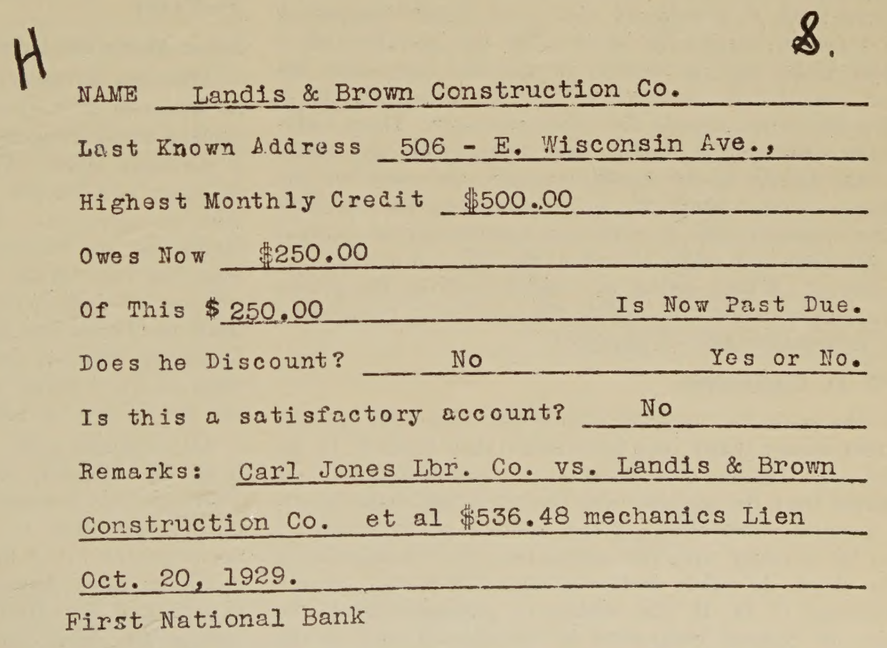
As a result of this rather chaotic condition many a man not deserving even a dollar's worth of credit, and who in all probability could not borrow a dollar from the block manufacturer if he had walked into his office and asked for it, was extended credit to the extent of several hundred dollars in a month's time.

And that method of doing business is hurting members of the Co-operative Association today. Many of them have hundreds, yes, thousands of dollars tied up today as a result of their anxiety to make sales without first investigating their customers from a credit standpoint. A central credit bureau, such as is maintained by the association, would have eliminated much of this and the need for such a bureau was one of the primary factors that led to organizing the association.

In developing its credit and collection department the association took the attitude that even in normal times every sale of block was a potential loss and a risk regardless to whom made. It is our feeling that when we deliver five hundred dollars worth of block to a customer we are investing five hundred dollars in that customer's business—an investment being made in a place where, in effect, it is beyond our control. If the customer is honest and capable of handling his business as it should be managed we realize on our investment. If he is dishonest and incompetent and as a result makes a failure of his business we get back only a small percentage of our investment and sometimes nothing. In such cases we, of course, realize no profit.

Credit Information Pooled

The first move after the organization of the association was the collection of credit information from our mem-



H

S.

NAME Landis & Brown Construction Co.

Last Known Address 506 - E. Wisconsin Ave.,

Highest Monthly Credit $500.00

Owes Now $250.00

Of This $ 250.00 Is Now Past Due.

Does he Discount? No Yes or No.

Is this a satisfactory account? No

Remarks: Carl Jones Lbr. Co. vs. Landis & Brown Construction Co. et al $536.48 mechanics Lien Oct. 20, 1929.

First National Bank

The original card on which credit information was collected. The "S" in the upper right hand corner denotes a slow rating for this firm. The "H" in the other corner signified the salesman most familiar with the account. The fact that a lien had been served on this firm was culled from the building and court record spoken of. The firm banks through the First Wisconsin National Bank bers. This absolutely precluded any other activity and the first man placed on the association staff was the man who was to have charge of this department. An accompanying illustration shows the card on which this preliminary information was collected. We wanted to know first of all the man's name and correct address. Next we wanted to know the condition of his account with the member from whom he had been buying. Then we wanted a checkup on his habits of paying—whether or not he discounted his bills. It might be added that in the Milwaukee market it is customary to allow a five per cent discount on all material paid for by the tenth of the month following delivery.

As fast as these cards came in they were sorted and filed alphabetically. They were the starting point of our credit system. One surprising thing cropped up in the collection of these cards—the fact that quite a number of contractors had in the past two years done business with as many as six or eight of our members *and were owing all of them.* When one man had pressed them too hard they had left him and gone over to the next man, repeating the performance as they were in turn pressed by the second manufacturer.

Rating the Contractor

Shortly after the entire group of cards was collected and sorted we started to go over them for the purpose of giving ratings. These sessions with the credit cards were long and arduous, but accomplished results. Fortunately we have a group of salesmen who are familiar with our customers and it was amazing the amount of information about a man that could be acquired through these round table discussions on credit. Every account was analyzed and given the rating we believed it deserved. Not only were a man's previous actions as shown on the card considered, but his character, business ability, assets, habits on the job and a checkup on the people for whom he did the majority of his work made. After many sessions the accounts were all classified and a visible file purchased to which the ratings were transferred.

This visible file is beside the telephone operator's switchboard and is used for a quick checkup on orders phoned in to the association. Each account, or name, in the file is keyed with a colored signal according to the rating accorded the account. For example, if an account is rated C. O. D. it is keyed with a red signal. Supposing that a man so rated calls in an order the operator immediately slides out the section of the file containing his name, sees that the account is C. O. D. and while she is taking the order signals the credit manager. Then, holding the customer on another line temporarily she states the case briefly to the credit manager and switches the customer over to him. He in turn explains the situation to the customer who is given an opportunity to explain his situation and asked to call at the office if possible to go over it. Where orders are called in from the plants of various members this visible file is referred to in every case before the order is accepted.

C. O. D. Customers

In the press for business during this past four months of tight money many jobs have been taken from C. O. D. customers. However, in many such cases a guarantee is obtained from the member who phones in the order assuring payment and allowing the amount to be deducted from his account with the association if it is unpaid in thirty days. In other instances where a mason on the association C. O. D. list wishes to purchase block the owner or general contractor is interviewed and if the latter's credit is deemed good permission is secured to bill the block to him. While this plan has worked out satisfactorily it is being dropped by the association and an absolute refusal of credit from C. O. D. customers instituted. The only excuse for its use the past four months has been a scarcity of business in the Milwaukee market and a desire to put through the association as large a volume as possible. It is indeed the old desire that was referred to in the opening paragraph, but in this instance instead of being satisfied blindly has been cared for in a manner that insures no loss.

The cards which were collected from members and on which the original credit ratings were made are kept as a part of a permanent file. Never a day passes but what some information is added to these cards. Experience shows the status of accounts to be constantly changing, necessitating changes in the ratings on these cards and a corresponding change in the visible file. As soon as an account is opened with a man and payment is made by check the name of his bank is added to the information on the card. We have in Milwaukee an excellent paper devoted to news of the courts and to the building field. This paper is watched carefully every day to determine whether or not any of our customers are in trouble or have liens or judgments filed against them. This information is placed on the cards and often results in a material change in the man's credit rating.

Opening an Account

If a man wishes to open an account with the association and we have no record of him we secure what information we can from the man himself and verify it through other credit agencies and firms with which he is doing business. It is the intention to make sure of every account on which we start delivery. Of course, we are not infallible and work ourselves into a hole occasionally. For example, we have at the present time the case of a man who bought goods from us during August and September on a large job. Payment was made promptly both months and a lien waiver issued in each instance. In October the contractor became involved financially and the association is temporarily "holding the sack" because it had failed to exercise its lien rights. The promptness with which the bills had been paid the first two months threw us off our guard and we had not served a notice of lien as is required by the Wisconsin statutes if lien is to be filed later.

Sales Made for Profit

Although the association has some six hundred accounts on its books at the present time an effort is made to check each of these frequently and each is made more or less of a personal affair. This checking is done by the credit manager and by the salesmen who are actively in touch with the accounts. The old argument about sales and credits has not entered association affairs, for each salesman has been made to feel that sales are made for the purpose of making a profit—and that profit is not made until the buyer has paid his bill. It is that splendid cooperation between the sales force and the credit department of the association that has been largely responsible for the success of both.

All accounts with the association are checked on the fifth, the fifteenth and the twenty-fifth of each month. There are two reasons for doing this—one to watch delinquents, the other to make possible the filing of a lien notice on the job if there is any feeling on the part of the credit or sales departments that some difficulty may be experienced in collection. On the basis of these checkups ratings are often changed in the visible file and on the master file.

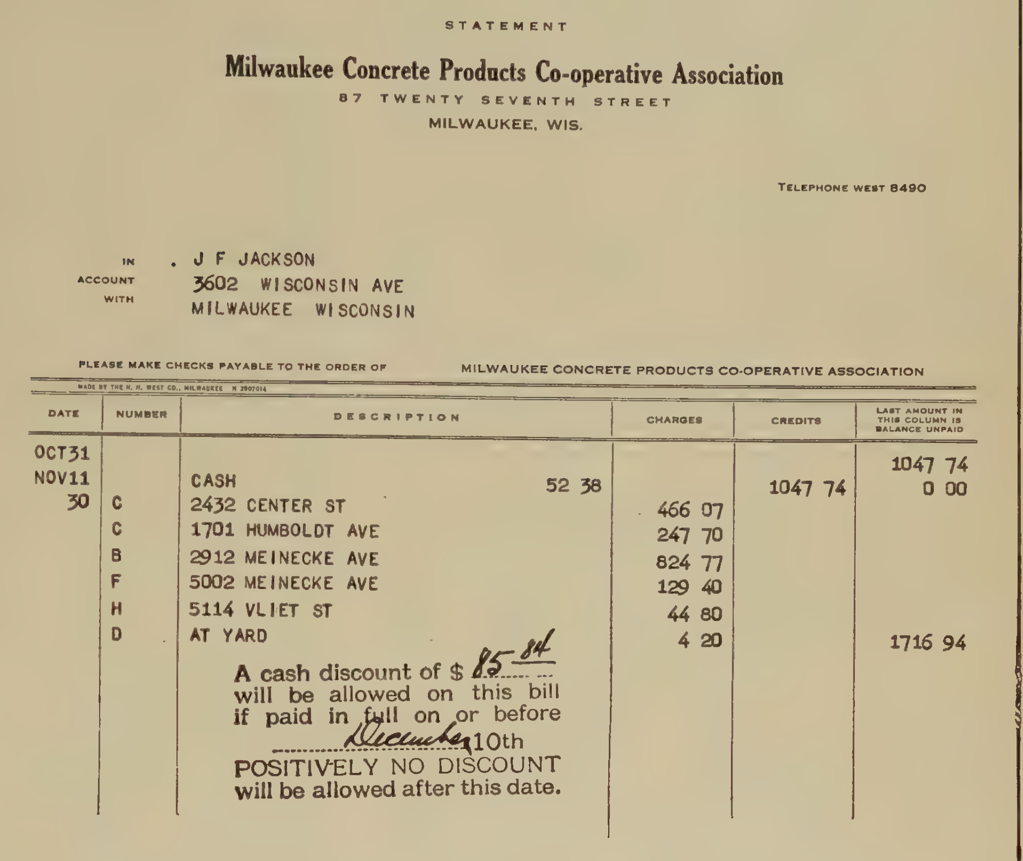
Billing Done Daily

Billing is done in the association offices daily—that is, as a job progresses the deliveries are taken from the manifest sheet explained in a previous article and entered on the invoice for the job in question. At the end of the month these invoices, together with a statement, are stapled together and mailed to the customer. Each statement is stamped with a rubber stamp stating that a discount of 5 per cent will be allowed on the previous month's business if paid for on or before the tenth of the current month. The collections are watched carefully up to and including the tenth when a list of delinquent accounts is made up. This list is then gone over by the credit manager, the salesmen and the manager of the association and is split into six parts, each man assuming responsibility for investigating the delinquent accounts in his territory or which he may have serviced in the course of his work.

At the time this delinquent list is made up the names are transferred to a card file by the credit manager. On these cards are noted the reports received on the delinquents and as the accounts are paid the cards are dropped from the file. Integrity and moral habits of the customers play a large part in the records of this file. If a man promises to pay on the fifteenth, but when that date rolls around ignores his promise with no explanation he is most surely marked as a poor moral risk. A repetition of this action is bound to carry his name to the C. O. D. list with its resultant red danger signal on the visible file.

Association Pays Manufacturers

As the association obligates itself to pay its members 88 per cent of the net selling price on the fifteenth of the month following sale one can easily see that not many accounts can be allowed to lag. For this reason an emphasis is placed on the advantages of the cash discount and all customers are urged to take advantage of it. Necessarily a rather firm attitude must be taken in this respect. We have on our lists many customers who have been "pets" of our members and who have been extended unusual terms. Our greatest difficulties lie with these men, who are so accustomed to paying their bills sixty to ninety days late and still being allowed their discount they resent doing otherwise.



STATEMENT

Milwaukee Concrete Products Co-operative Association
87 TWENTY SEVENTH STREET
MILWAUKEE, WIS.

TELEPHONE WEST 8490

IN ACCOUNT WITH
J F JACKSON
3602 WISCONSIN AVE
MILWAUKEE WISCONSIN

PLEASE MAKE CHECKS PAYABLE TO THE ORDER OF MILWAUKEE CONCRETE PRODUCTS CO-OPERATIVE ASSOCIATION

MADE BY THE H. H. WEST CO., MILWAUKEE H 2907014

DATE	NUMBER	DESCRIPTION	CHARGES	CREDITS	LAST AMOUNT IN THIS COLUMN IS BALANCE UNPAID
OCT31					1047 74
NOV11		CASH 52 38		1047 74	0 00
30	C	2432 CENTER ST	466 07		
	C	1701 HUMBOLDT AVE	247 70		
	B	2912 MEINECKE AVE	824 77		
	F	5002 MEINECKE AVE	129 40		
	H	5114 VLIET ST	44 80		
	D	AT YARD	4 20		1716 94

A cash discount of $ 85.84
will be allowed on this bill
if paid in full on or before
December 10th
POSITIVELY NO DISCOUNT
will be allowed after this date.

The customer is made to realize that he can save himself considerable money by a prompt payment of his bills. The discount stamp is used as this reminder

Legal Action

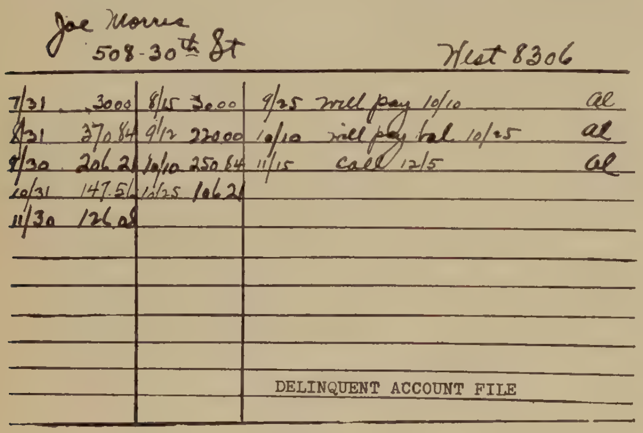
Thus far in the life of the association we have had little occasion to resort to drastic or legal means of collecting our accounts. In every instance where there is any element of doubt about an account it is protected by a lien notice. Often the mere service of this notice is sufficient to have the owner call and make arrangements to have the bill paid. Before the lien is filed we make a point of notifying the owner by telephone so that by paying the account he can avoid having a lien filed against his property. When legal action must be resorted to we are guided by the following list taken from a manual on credits and collections published by one of the large cement companies:

1. Final Demand for Payment
2. Liens
3. Attachment
4. Garnishment
5. Replevin
6. Injunctions
7. Sale of Collateral
8. Bankruptcy
9. Actions at Law
10. Civil Arrest in Fraud

11. Criminal Proceedings
12. Proceedings against
    a. surety
    b. guarantor
    c. bonding company.

Actions of this sort necessarily cost money and cut down profits. It is hoped that we can avoid as much of this as possible by having such a good record of credits that sales will not be made to customers who require legal persuasion as a collection method.

Letters have been used very little so far in our collection work. It has been our aim to keep our delinquent accounts down to the point where personal contact can be made on each one. So far we have been able to accomplish this purpose. A series of collection letters, extremely human and applying to the concrete products business have been prepared and will be given a tryout this winter to determine their effectiveness as a collection medium.



Joe Morris
508-30th St
West 8306

7/31 30.00	8/15 30.00	9/25 will pay 10/10	al
8/31 370.84	9/12 220.00	10/10 will pay bal. 10/25	al
9/30 206.21	10/10 250.84	11/15 call 12/5	al
10/31 147.56	10/25 106.21		
11/30 126.08			
		DELINQUENT ACCOUNT FILE	

This is a delinquent account card used in following up all accounts that run past the discount date. The first column denotes the amounts due and the second payment made on the account. It is not often that an account as habitually delinquent as this one is carried; it is simply used as an example

As the potential business of the association will run approximately a million dollars a year one can easily see that the task of collecting it is one of great importance. This explains why in the Milwaukee Concrete Products Co-operative Association every salesman has had firmly implanted in his mind the idea mentioned in a previous paragraph—that the sale is not complete until the buyer has paid for the goods sold and that unless credit is wisely given the sale will result in a loss and be worse than no sale at all. For the past few years Milwaukee concrete products manufacturers have been giving more thought to volume of sales, expansion of markets and multiplication of outlets than they have volume of collections on these sales. It is the purpose of the association to think of these in equal terms. Credit losses will, of course, never entirely disappear, but by constant vigilance on the part of our credit department we believe they can be pared to a negligible figure.

The Fowler Architectural Award Closes January 20th

January 20th has been set as the closing date to receive material for the consideration of the American Society of Civil Engineers Committee having in charge the selection of winners of the Phebe Hobson Fowler Architectural award.

Data for consideration in this competition should consist largely of photographs of completed work. Consequently the time is not too late for designers of meritorious structures to submit the necessary material.

The Phebe Hobson Fowler Architectural award was established in 1928 by Charles Evan Fowler, a consulting engineer of New York. Designs for which the award is made must be artistic, complying with the principles of simplicity, symmetry, harmony and proportion, and not merely a structure decorated with architectural details or trimmings. Only completed work will be considered.

The award shall preferably be made for a work of outstanding merit in the architectural design of a bridge.

Members of any grade of the American Society of Civil Engineers are to be considered first as to eligibility for the prizes. Nevertheless, the award may be made to members of the other three national societies of mining, mechanical and electrical engineering in any grade, providing no work of sufficient merit has been achieved within or submitted by the membership of the American Society of Civil Engineers. Eligibility is extended also to editors, authors of books or papers, professors, or others who shall have contributed in some outstanding manner to the betterment of engineering architecture.

Should no award be possible for work that is wholly that of an engineer, the award may be made for a design that is fundamentally the work of an engineer but on which an architect assisted in the details. An architect who is a member of the American Society of Civil Engineers or one of the other national societies named would stand eligible for the award, the same as any other member.

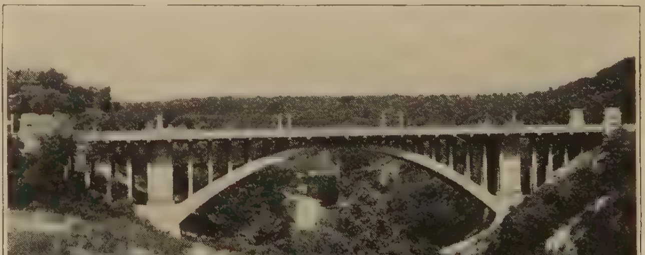
The Fowler award consists of three prizes. The first prize is a gold bronze medallion; the second is a silver medallion; and the third is an honorable mention and certificate. Each prize is to be accompanied by an engraved certificate which shall recite the purpose of the award and the special achievement for which it is granted.

A liberal number of photographic views not smaller in size than 8 by 10 inches, accompanied by a brief description reciting the history of the structure, will constitute the best form of presentation. At least one photograph should be a broad-side view, if possible.

It is considered entirely appropriate for an engineer who has a worthy achievement to his credit to initiate the submission of the necessary photographs and other data and to forward the material for the consideration of the committee.

The material should be mailed to the American Society of Civil Engineers, 33 West 39th Street, New York, accompanied by a letter of transmittal stating that it is being submitted for the consideration of the Phebe Hobson Fowler Architectural Award Committee. It should reach its destination not later than January 20th.

In 1929 the second prize was awarded to John D. Stevenson, chief engineer of the Bureau of Bridges and Structures, Pittsburgh, Pa., for the design of the Beechwood Boulevard bridge in that city and shown above.



~ EDITORIAL ~

Pavement Practice Grows More Uniform

THE year 1929 has seen the addition of about 8,500 miles of concrete highway pavements to the road systems of the United States, and the construction of about 51,000,000 square yards of new concrete pavements in the streets of towns and cities. These figures are practically equal to the corresponding figures of 1928, although street paving fell slightly below the previous year.

Much space is given in this issue to the recording of progress in concrete highway and pavement construction. One of the most important items in this progress is found in the more general adoption of refinements in construction methods.

Another interesting development during 1929 is noted in the increase in sentiment favoring paved highways in the less wealthy sections of the country where comparatively little had been accomplished heretofore. Notable among these sections are the states of Louisiana and South Carolina, where large bond issues have taken effect, and in Georgia, where the adoption of a gasoline tax brings the necessary funds into the hands of the state highway department. Public sentiment has also been developed in favor of increased highway construction programs in Texas, Oklahoma, Mississippi and Alabama. In these states sufficient concrete road mileage has been built to impress the taxpayers with the economic value of such highways, with the result that more state road money is demanded.

The year just closed has also seen definite progress toward co-ordinated research in problems concerned with concrete highway construction. In times past the various state highway departments have carried on independent research work without definite knowledge of investigations under way by similar departments in other states. Fortunately there is now a distinct inclination to co-ordinate these activities in order that problems of common interest may be solved through combined effort and for the benefit of all.

◆

Greater Bridge Concrete Strengths

THE Committee on Bridges and Structures of the American Association of State Highway Officials is giving consideration to the complete revision of the bridge specifications of that organization.

The present concrete specification of the American Association of State Highway Officials is based on four arbitrary mixtures, ranging from 1:3:6 to 1:2:3, with assumed 28-day crushing strengths ranging from 1,500 to 2,800 pounds per square inch. Working stresses permitted in concrete bridge design are conservatively low. For illustration, the flexural compression on concrete under bending stress is limited to 650 pounds per square inch for the 1:2:4 mixture. An increase of only 15 per cent above this figure is permitted in 1:2:3 concrete, for which the assumed 28-day crushing strength is 2,800 pounds per square inch.

The water control feature of the A. A. of S. H. O. specification is woefully inadequate, consisting of nothing more than the provision that "In general, a mixture shall be used which contains the minimum amount of water consistent with the required workability."

The importance of the specification sponsored by the A. A. of S. H. O. lies in the fact that the federal government will not extend financial aid when the stresses employed in bridge work are higher than those specified by the association, regardless of the actual strength and quality of the concrete.

The situation created by this state of affairs is not only unfair, but it stands as a definite obstacle to the use of concrete of high strength and a high degree of density.

Obviously, bridge engineers will not specify high-strength concrete and assume the responsibility of the more careful supervision involved unless they are permitted to employ proportionately higher working stresses in design. Until this permission is granted their hands are tied, and they must continue to design concrete bridges on an uneconomical basis. If the restrictions are removed, progressive bridge engineers will build structures of lower cost, but of far greater strength and durability than the general run of bridges now being built in federal aid highway work.

◆

Stretching Credit

SOMEWHERE near the limit of credit elasticity is reached when the purchaser of concrete products is able to do business with half a dozen manufacturers within a period of about two years and continue to owe all of them.

This is one of the practices on the part of products users revealed during the course of organizing the concrete products industry's initial co-operative venture. Without doubt the elimination of this evil alone will justify co-operative effort of some kind, even though far short of the attempt being made in and around Milwaukee.

OUR NEW EDITOR

EFFECTIVE with this issue, Norman M. Stineman becomes Editor of CONCRETE.

By education and experience, and natural talent, he is exceptionally well qualified to direct the policy of a publication covering as specialized and yet as comprehensive a field as ours.

His technical training consists of three years of drafting and architectural designing in Buffalo and Toronto, followed by a four-year course at Ohio Northern University, from which he received his degree in Civil Engineering in 1911.

The six years following his graduation were spent in the Engineering Department of the Chicago, Milwaukee and St. Paul Railway at Chicago, the first three years being spent in designing grain storage terminals, steel and concrete bridges, viaducts, and grade separation structures. The next three years he was office engineer in charge of preparation of plans and specifications for railway passenger and freight stations and other railway buildings. During this period he was awarded the Octave Chanute bronze medal of the Western Society of Engineers for developing original and workable formulas for several types of engineering structures, the work being published in the Journal of the Western Society of Engineers, November, 1914.

Norman M. Stineman

During the summer of 1917 he was chief engineer of the La Salle Engineering Company, structural engineers, Chicago, from which position he resigned to enter military service in the Great War. Having been commissioned as captain in the Engineers' Reserve Corps, following five months' military service on the Mexican border, he served fourteen months in France in command of Company D, 33rd Engineers.

During his stay in France, he was engineer officer in charge of construction of the car repair yard at Nevers, involving grading, excavation, etc., and erecting machine shops, as well as building smaller military engineering work.

After a few months in 1919 as Chief Draftsman of the Bureau of Bridges of the Indiana State Highway Department, he entered the service of the Portland Cement Association as structural engineer in October, 1919, during which ten-year period he has been in charge of special work on revision and preparation of city building regulations, and has also specialized in fireproof construction, building economics, financing and statistics, as well as designing of buildings, bridges, dams and other engineering structures.

In 1925 he was assigned to study the structural effects of the Santa Barbara earthquake; in 1926 he was given a similar assignment to study and report on the structural effects of the Miami and Cuban hurricanes; in 1927 he was again sent out to study and report on the structural effects of the St. Louis tornado.

Since January, 1929, he has assisted in drafting a new building code for the city of New York, as a member of the New York Building Code Sub-committee on Reinforced Concrete, and of the Sub-committee on Masonry, which work is now practically completed.

Mr. Stineman is an associate member of the American Society of Civil Engineers, associate member of the Western Society of Engineers, member of the Society of American Military Engineers, member of Castle Post 151 of the American Legion, member of the board of trustees, Ohio Northern University, member officers' reserve corps, and Registered Structural Engineer, State of Illinois.

No picture of a man is complete without his personal background, so let us add that he is married, has two children, and is an Episcopalian.

Mr. Stineman takes over the position of editor of CONCRETE, so ably filled for three and a half years by Otto A. Steller, who has resigned to make his home on the Pacific Coast and to become affiliated with the McEverlast Company, Incorporated, at Los Angeles. Mr. Steller was very active in recommending Mr. Stineman as his successor and in securing his services, and it is Mr. Steller's hope, as well as ours, that he may have the same kindly and hearty co-operation from our friends in the industry as he did.

CONCRETE PUBLISHING COMPANY.

Sheet Concrete Pavement

Placed on

Ambassador Bridge Approaches

Large Areas of Approach Pavement Placed for New Bridge Across Detroit River—Project Includes 60,000 Sq. Yds. of Concrete Pavement and 8,000 Sq. Yds. of Sidewalk

THE pavement for the approaches of the Ambassador bridge across the Detroit River, connecting Ontario with Detroit, Michigan, was constructed of concrete by the sheet concrete method to provide a resurfaceable concrete pavement on earth fill. It extends from the main thoroughfares intersecting at the approach to the first span of the land section of the bridge.

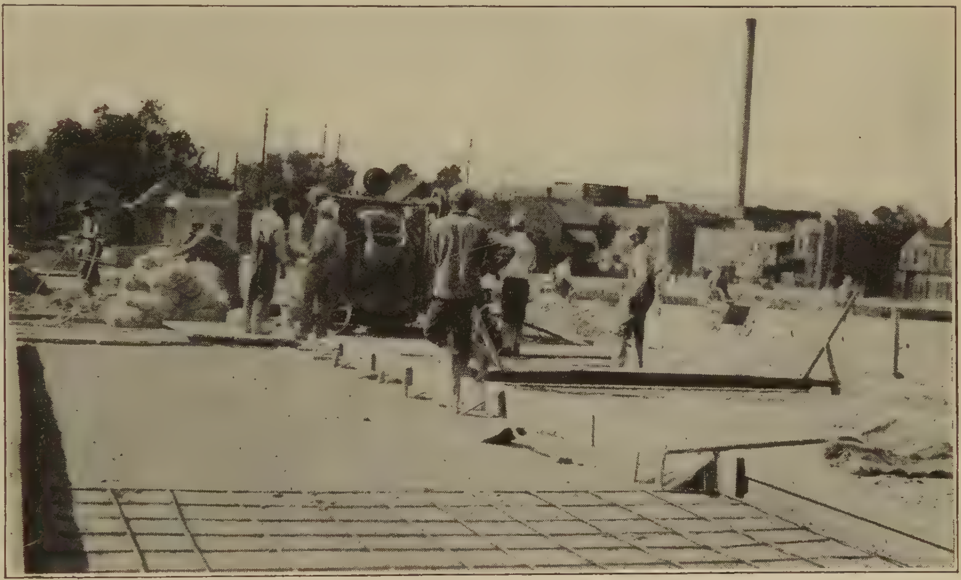


Figure 1. The mixer was located on the ground level and discharged directly into buggies in which the concrete was transported to the subgrade

The total Ambassador Bridge project includes approximately 9,000 feet of bridge-way, measuring from the end of the Canadian terminal to the end of the Detroit terminal, with a single suspended span, 1,850 feet long over mid-river. The bridge will have an unobstructed roadway forty-seven feet wide with a capacity of five lines of traffic, and sidewalk eight feet wide. The total yardage of pavement involved was approximately 60,000 square yards and of sidewalk 8,000 square yards. It is on the approaches that the sheet concrete method was used.

The American approach begins at Twenty-first and Porter Streets and was built on an earth fill with a five per cent grade. An idea of the expanse of the approach pavement will be gained from the accompanying illustrations. The width narrows from a maximum of four hundred feet at Twenty-first and Porter Streets and through the row of offices which divide the approach into thirteen individual traffic lanes, to the bridge proper.

Sheet Concrete Placed

The method followed consisted of laying a 7-in. base course of concrete, using a 2-in. top separated from the base by a sheet of coarsely woven burlap, making the total thickness of the slab 9 in.

The base course was broken stone concrete mixed in proportions 1:3:4½ and 1:2½:5, using six to six and one-half gallons of water per sack of cement.

The top course was made of 1:1½:2 concrete, using pebbles for the coarse aggregate. The amount of water used was from five to five and one-half gallons per sack of cement.

The aggregates for the base course were trucked to a central mixing plant, located at one section of the bridge approach, and dumped from the trucks on an incline extending from the street level to the top of the storage hoppers. A hoisting engine used to operate the concrete skip also operated a cable attached to a hand scraper with which workmen scraped the aggregate up the incline to the top of the bins. Charges for the mixer were measured directly from these storage bins into the divided charging hopper of the mixer. The mixer was located on the ground level and discharged directly into a skip bucket and the mix was elevated to a sufficient height to permit discharge by gravity into the dump trucks. These dump

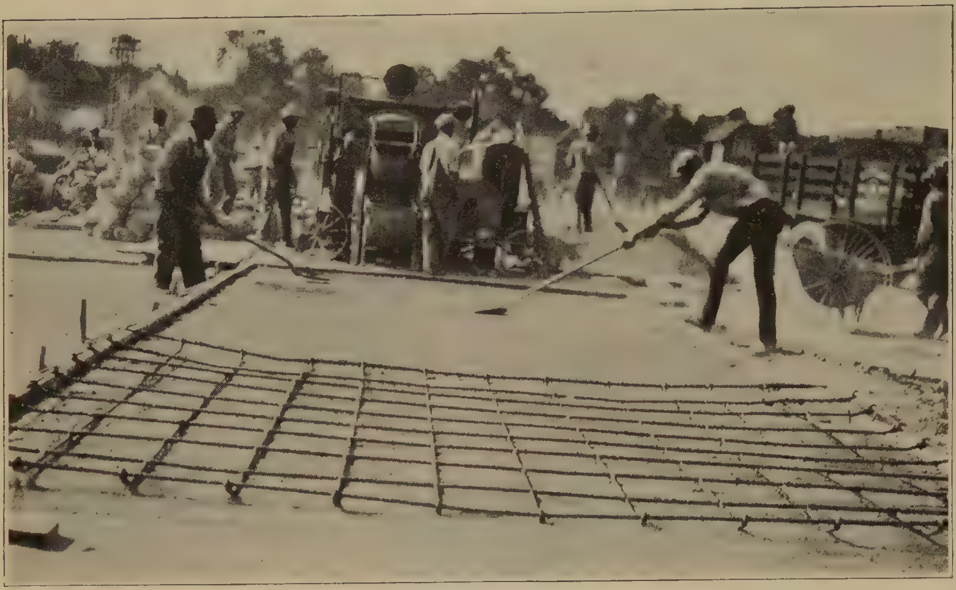


Figure 2. A specially designed steel mat was placed on the burlap covering the base course to prevent it from being misplaced when the concrete for the top course was placed

trucks conveyed the concrete over the grade to the section where pouring was in progress.

Pavement Placed in Rectangular Sections

As shown by the accompanying illustrations, the work was carried on so the pavement was built in rectangular sections, side forms being set to the proper elevation and grade. These sections were thirty feet long and eleven feet nine inches wide, containing approximately forty square yards of nine-inch concrete pavement, or ten cubic yards of concrete each.

When the concrete for the base course was discharged by the dump truck it was leveled and screeded to the required elevation to get the proper surface, and the sheet of burlap was applied immediately before any setting action of the cement took place. A specially designed steel mat shown in Figure 2 was next placed upon the burlap to prevent its being misplaced when the concrete which comprised the top course was placed. The method for handling the aggregates for the top course differed from that used in mixing the base course as is evidenced in Figure 2. A portable mixer was kept near the panel in which work was going on and the cement, sand and pebbles dumped adjacent to it so that the materials could be measured directly into the hopper of the mixer.

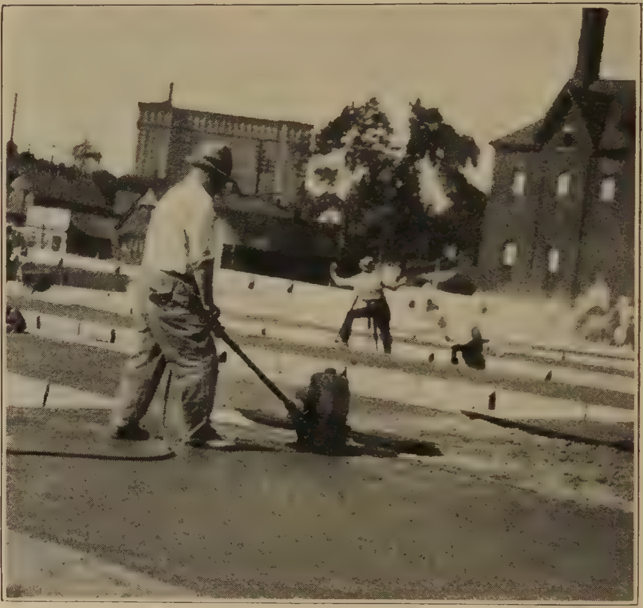


Figure 3. An electrically operated surfacing machine finishing the top course of the pavement. Sections of pavement in various stages of completion are also shown

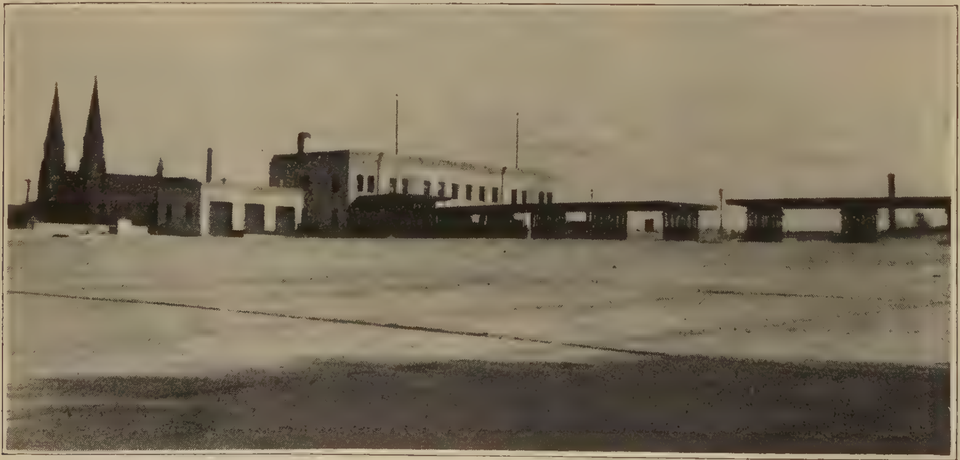


Figure 4. View looking across the approach, with the bridge terminal building in the center. The finished pavement is shown in the foreground

As soon as the top course was dumped from the concrete buggies and spread over the steel mat, the mat was removed by working it to the top of the concrete and then lifting it out of the way bodily. Reinforcing steel used in the base course is shown in Figure 1. The side forms for the panels were so constructed as to provide a keyed joint between various adjoining panels.

Finishing the Wearing Surface

The wearing surface of the concrete was finished with an electrically operated rotary finishing machine as shown in the illustration. The finished slab presented a rough sanded appearance designed to provide traction on the grade. After being finished, the various sections were covered with sand and kept moist for sufficient length of time to insure proper curing of the concrete.

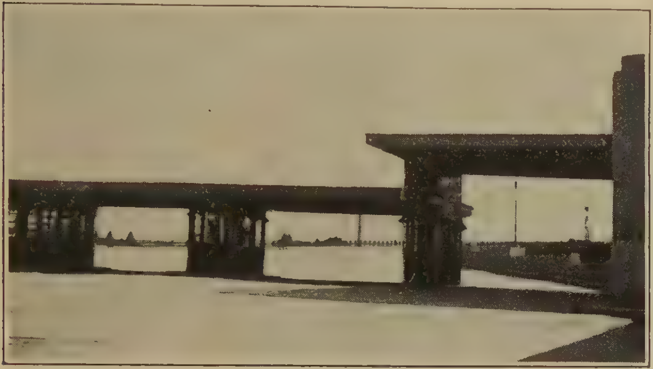


Figure 5. The beginning of the narrow approach to the first span

Premoulded expansion joints were placed across the approach pavement, spaced two sections or sixty feet apart. Longitudinal expansion joints were provided every fourth section or approximately forty-seven feet apart.

Test cylinders were made for samples of the concrete used in the pavement so as to keep a record of the quality of the concrete going into the work. Some of these cylinders were broken at the age of seven days and others at twenty-eight days, being cured in a small field laboratory on the job. The cement used throughout the entire paving project was standard portland.

A schedule was worked out by the contractors so that twenty-five squares, or one thousand yards of pavement, was constructed in one day. The work was also timed so that the finishing machines followed directly after the mixing and placing and the surface was worked when the concrete was in the proper condition for finishing.

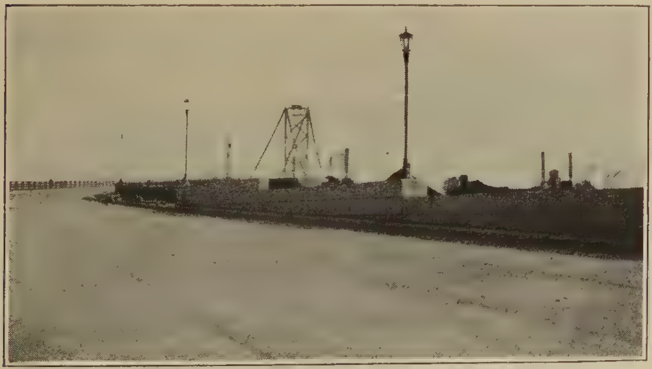


Fig. 6. A section of the approach immediately adjoining the first bridge span

The Ambassador bridge was built for the International Bridge Company. The engineer and contractors were the McClintic-Marshall Company, and the W. E. Wood Company, Detroit, was the paving contractor. The resurfaceable concrete pavement on the approach was constructed under the supervision of the Sheet Concrete Pavement Corporation of America.

Mixer Trade Practice Rules Approved by Commission

Eleven rules of business practice adopted by the manufacturers of concrete mixers and pavers at their trade practice conference held with the Federal Trade commission last fall have now been affirmatively approved by the commission as applying to unfair methods of competition. Eight other rules adopted by the industry were accepted by the commission in the class known as expressions of the trade.

The first group of rules pertaining to unfair methods of competition cover such practices as representation by a manufacturer that the capacity of any concrete mixer or paver is greater or less than its published rated capacity; circulation by a manufacturer of false statements concerning production, ability or financial standing of his company, or of a competitor; false statements regarding size, weight, design or performance of his machines or of a competitor's machine; enticing employes of a competitor to violate their contracts of employment; inducing breach of contract; payment of secret rebates; discrimination in price by selling to favored customers a new model concrete mixer or paver as an old model or repossessed or rebuilt machine; and selling of concrete mixers and pavers without profit or below cost for the purpose of injuring a competitor.

The second group of rules accepted as expressions of the trade concern such subjects as published prices; allowance of special price; uniform cost accounting; quotations f.o.b.; and creation of a committee on trade practices to investigate and determine whether the resolutions adopted at this conference are being observed.

Winning Airport Design Announced

A. C. Zimmerman and Wm. H. Harrison, associated architects and engineers of Los Angeles, Calif., were recently announced as the winners in the Lehigh Airports Competition. Prizes totalling $10,200 were awarded by the Lehigh Portland Cement Company, sponsors of what was said to be the first American contest for designs of modern airports. The victors submitted a joint design.

Coming Conventions

January 11th to 18th—American Road Builders Association twenty-seventh annual convention and road show. Auditorium, Atlantic City, New Jersey.

January 20th to 22nd — National Crushed Stone Association, thirteenth annual convention. Hotel Gibson, Cincinnati, Ohio.

January 29th and 30th—Wisconsin Concrete Products Association annual meeting, Milwaukee.

February 10th—National Concrete Products Association annual meeting. Hotel Roosevelt, New Orleans, La.

February 11th to 13th—American Concrete Institute annual convention. Hotel Roosevelt, New Orleans, Louisiana.

Proposed New York Code Will Embody A. C. I. Regulations

Clause on Reinforced Concrete Requires Engineers' Affidavits of Compliance With Plans

The first meeting of the General Advisory committee appointed to consider the proposed new building code for New York City was held on December 12th, under the chairmanship of Irving T. Bush, of the Bush Terminals Company. Completed reports were submitted by the sub-committees on reinforced concrete, on structural steel, on timber construction, on foundations and on fireproofing. The report of the sub-committee on masonry was expected to be ready in a week or two.

The reports dealing with reinforced concrete, structural steel and foundation construction contain identical clauses requiring the designing engineer as well as the supervising engineer to furnish affidavits to the effect that the structure has been built in accordance with the plans and specifications filed with the city building department. The report on reinforced concrete is a slight modification of the American Concrete Institute regulations.

In its arrangement the proposed code will constitute a new and a commendable departure in municipal building regulations. Only the definitions and a few other provisions of a general character will comprise the building code proper. All parts dealing with construction regulations, fire-resistive standards and related matters, making up by far the greater bulk of the reports, are to be promulgated as "rules" by the Board of Standards and Appeals created by the present building code. This will greatly simplify the procedure in adopting future amendments or revisions, since such changes may be made by the Board of Standards and Appeals without the necessity of obtaining legislative sanction.

The membership of the General Advisory Committee includes representatives of all elements concerned with the building industry, besides all the members of the various sub-committees. The new building code is being sponsored by the Merchants' Association of New York, acting on the invitation of Mayor Walker.

Products Meeting Scheduled for New Orleans

The annual meeting of the National Concrete Products Association will be held Monday, February 10th, at the Hotel Roosevelt, New Orleans, La. It will thus precede the A. C. I. gathering at the same place.

Members are urged to attend so that the future course of the association may be determined.

Federal Aid Pavements

Figures compiled by the Bureau of Public Roads of the U. S. Department of Agriculture indicate that a total of 7,814 miles of road and 47 miles of bridges were improved in 1928 with state and federal funds.

With state funds alone the states improved 21,391 miles of roads, and the counties and other local units constructed 45,531 miles of county and local roads.

How to Save on Concrete Formwork

By A. B. MacMILLAN

(Continued from Page 20)

Wall forms may be braced by exterior bracing if the amount of concrete involved is small and if there is room for the bracing on both sides of the wall. This method is uneconomical, for it involves the use of an undue amount of material and labor. It is not recommended as general practice. Greater economy of both material and labor will result from the use of separators, tie bolts or wire ties and waling timbers, as shown in Figure 7 and described below. Special form clamps, designed to simplify the use of wire ties and to eliminate exterior bracing, are on the market.

It is necessary to use spacers or separators within the wall space to hold the forms apart and thereby maintain the required wall thickness. These separators may be short wooden struts or blocks of concrete, the latter being cast on the job. Various patented connections on the market which act both as ties and separators may frequently be used to advantage.

In our organization we make frequent use of a special concrete separator, cast 3 in. square and any length required, and with a hole through the center for the insertion of a ¾-in. bolt. A detail of this separator and the mold in which it is cast are shown in Figure 8. Holes drilled through the form board and the uprights or wall studding on each side of the wall allow the insertion of a bolt, which is passed through the hole in the concrete separator and tightened up. Sometimes we use horizontal waling timbers to engage the bolts, the waling timbers being held against the uprights. The use of waling timbers reduces greatly the number of separators and bolts required. The separator maintains the required wall thickness and the bolt passing through it serves as a tie, exterior bracing being completely eliminated.

When the forms are stripped the bolts are withdrawn and the holes are filled with mortar. If the location is below the ground level the hole should first be plugged with oakum or similar material before applying the mortar. Otherwise, leakage may develop in time.

The next article will deal with form work for wall pilasters and for exterior columns of rectangular, octagonal and circular sections.

Increased Building in 1930 Likely, Says P. C. A. Head

In reply to a letter from CONCRETE asking his opinion of the effect of the Hoover conference plans on 1930 construction, Frank H. Smith, president of the Portland Cement Association, wrote as follows:

> "The published statements concerning what I said at the recent presidential conference in Washington appear to be correct. A survey made by the Portland Cement Association prior to the conference indicated to us that shipments of cement during 1930 would be somewhere between 5 and 10 per cent less than they would be in 1929. Naturally, if the program of the President results in increased construction, it would change the Association's estimate, and it is now hoped by cement manufacturers that 1930 shipments will equal those of 1929."
>
> "There is no doubt but what the downward tendency of money rates will change the flow of money, to some extent at least, into the mortgage field, which would naturally stimulate building."

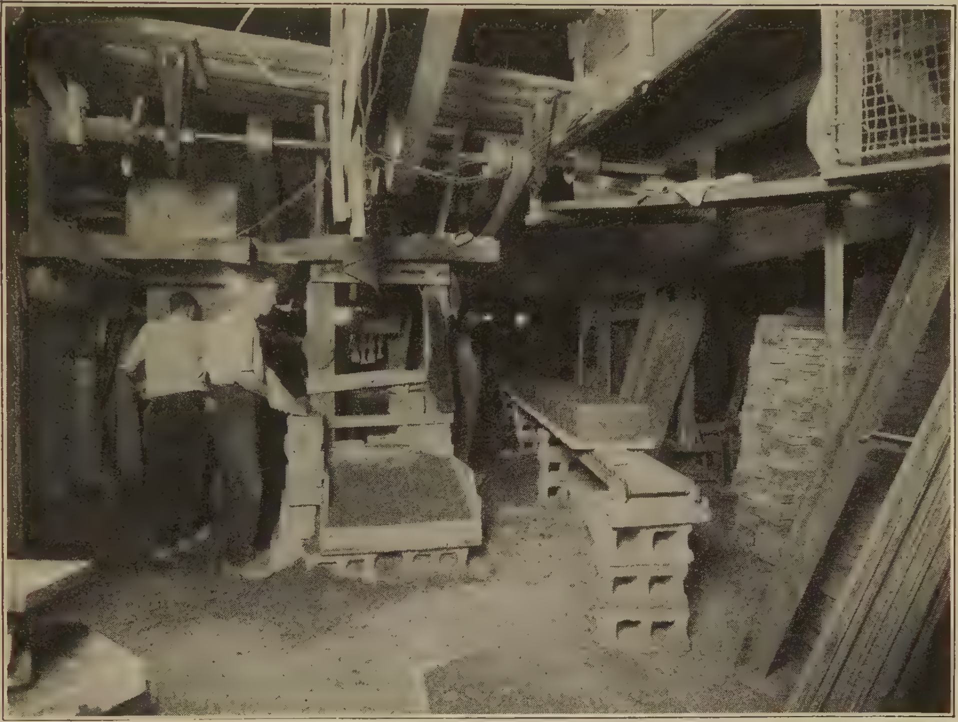
Block Plant Conveying Methods

An Analysis of Methods Used to Convey Raw Materials and Finished Block in Products Plants

By HAROLD T. HANSEN

THE concrete block plant and the artificial stone plant have been neglected by materials handling engineers. The owners themselves do not, in many cases, appreciate that their product can be handled faster and cheaper mechanically.

There are, however, a few plants that have experimented with conveyors and have conclusively proved their worth. Notable among these is a prosperous artificial stone plant in Toledo, Ohio. This plant at the last accounting had more overhead tramrail, as far as dollar and cents value is concerned, than the entire value of the rest of the plant, and the investment is well warranted.



Conveying green block from the machine to the curing rooms by roller conveyors at the plant of the Straub Block Company, New Kensington, Pa.

Unloading cement into storage with a roller conveyor

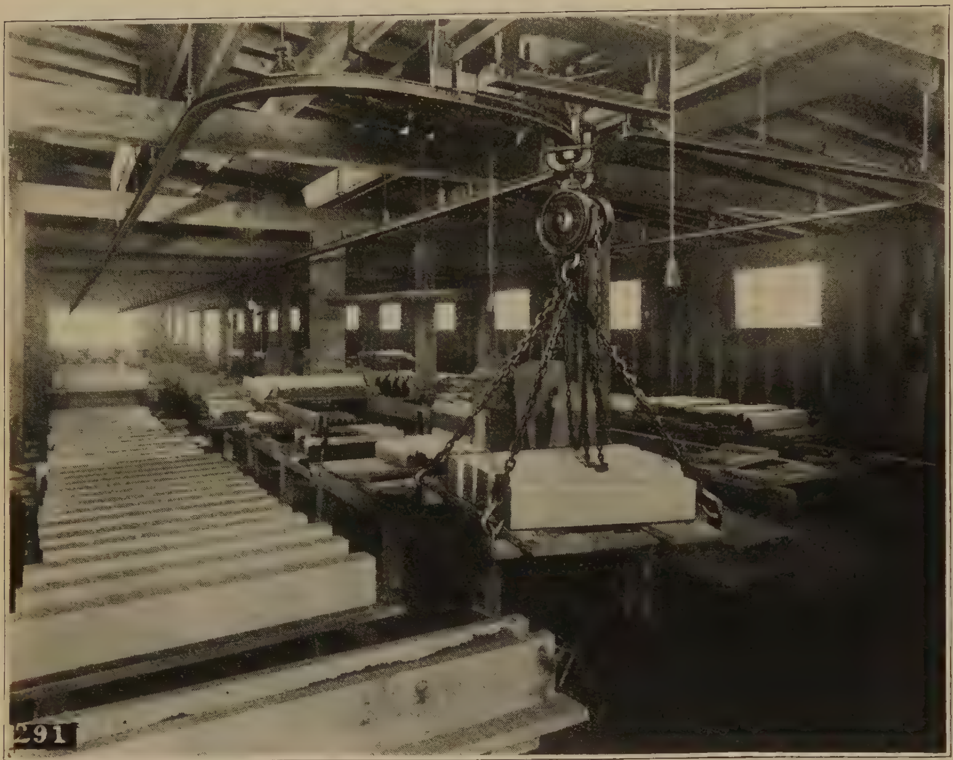
Mechanical Handling

In the artificial stone plant referred to, the application of mechanical handling begins at the railroad siding with the incoming aggregates. A portable trough belt conveyor will unload a car of sand and deposit it in a storage bin in a few hours. The first cost and maintenance of a portable trough belt conveyor is small in comparison to the savings inaugurated. It offers a desired degree of flexibility and yet is fast and efficient. If the plant is large enough to justify a silo for storage, a skip-hoist will unload a car in a minimum of time.

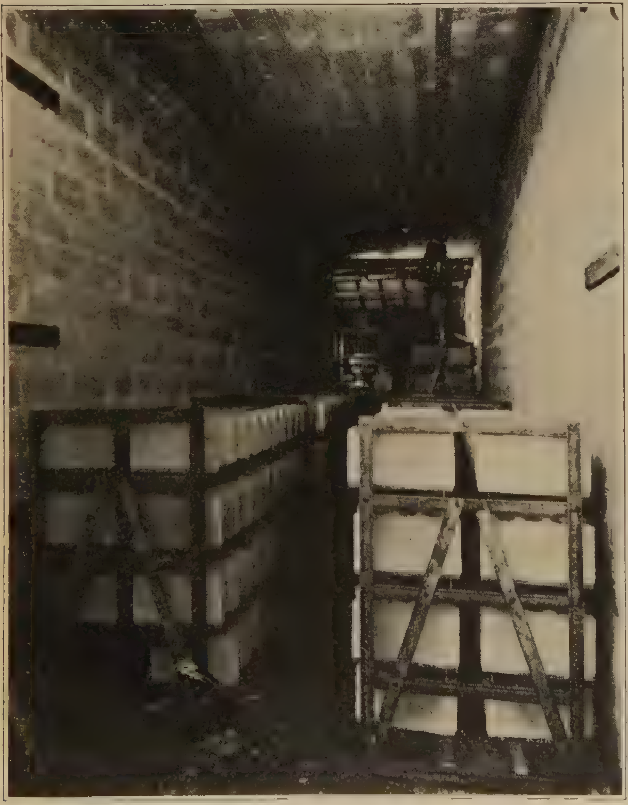
Bagged cement can very readily be handled on pallets over roller conveyor. Four or five 8-ft. sections and a 90 degree curve will reach from the inside of the car well into the storage warehouse. This conveyor can be taken down and be relocated very easily. The sections are joined together by means of universal couplings, requiring no wrench. The curved section is reversible, making either a right- or a left-hand turn. The rollers should be of the flanged type so that the conveyor can be used for handling the finished stone, too. Tapered rollers on the curved section are desirable.

Aggregate Handling

Having gotten the aggregates into storage the next step is to get them out of storage and into the mixer in the proper proportions. Some plants store the aggregates in hopper bins on the floor above the mixers and operate a batch bucket on a double tramrail track under the bins and above the mixers. In order to assure accurate proportions in the mix, the batch bucket is mounted on a scale mechanism. The operator pushes the bucket along under the hoppers, the shut-off gate in the bottom of each hopper is opened and the proper weight of each ingredient is let into the bucket. The bucket is then pushed along the tramrail tracks to a position above a mixer and the load is discharged through the bottom of it into the mixer.



Overhead tramrail handling cast stone



The overhead tramrail in the curing rooms

The molds are usually in close proximity to the mixer, eliminating the necessity of a conveyor. If any distance is to be traversed a bottom-discharging bucket on an overhead tramrail system will do the work.

Conveying Green Units

The green stone on its bottom board can be moved to temporary storage either on an overhead tramrail system or on a roller conveyor system. After the stone has sufficiently dried and set it goes on to the storage yard, this handling again being accomplished by either roller conveyor or tramrail. A hand propelled crane of the transfer type gives very complete coverage of the storage yard. If, instead of a crane, single lines of tramrail are used a few short sections of roller conveyor will greatly facilitate the handling of the stone to points not covered by the tramrail.

When a roller conveyor is used for transporting stone a flanged roller is most adaptable; it has been found much superior to a plain roller with guard rails. Guard rails are apt to chaff and chip the stone; flanged rollers do not require guard rails and therefore eliminate this danger.

Not every artificial stone plant can apply all of these methods of conveying their raw materials and finished product, but it is safe to assume that one or more of these systems can be adapted to the handling problems of most plants.

Handling Concrete Blocks

The concrete block plant offers splendid opportunities for mechanical handling. The Grand Rapids Builders Supply Company, manufacturers of concrete blocks, have a tramrail system that it is estimated saves them 75 cents for every hundred blocks manufactured. This installation paid for itself in less than a year.

Stockpiling with the help of a roller conveyor at the plant of the Diamond Concrete Block Company, Sharpsburg, Pa.

Racks with a capacity of 70 blocks are moved through the plant on the overhead tramrail system. The racks are filled at the molding machines. Loaded racks are picked up by means of a twin hook chain hoist carrier and are pushed into the drying kilns where they are set on the floor in close formation. After the blocks are cured the racks are again hoisted and are pushed out into the storage yard, where the blocks are taken off the racks and piled. The empty racks are returned to the molding machines.

Stockpiling by means of an overhead tramrail system which extends from the machines through the curing rooms to the yard

The same conveyors are used in the concrete block storage yard as have previously been described in reference to artificial stone storage yards. Likewise the handling of the aggregates are similar in both industries.

Roller conveyors can also be applied to the handling problems of the concrete block plant. The roller conveyor system can be made to accomplish practically the same results as the overhead tramrail system and has an advantage of added flexibility in regard to location, in that it can be taken down and set up in a new location with the expenditure of very little time and effort. An overhead tramrail system is a rather permanent installation. Once erected it is not easily moved.

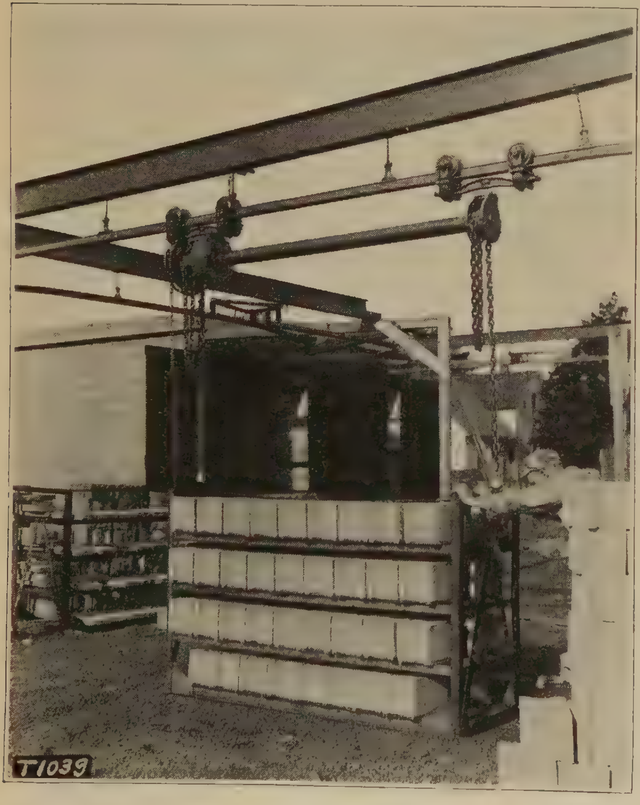
Roller conveyor handling cast stone

In order to convey the green block on roller conveyors, a pallet about three feet long must be used. These long pallets minimize the jolts and jars and prevent the block from breaking down. The cured blocks are of course permitted direct contact with the steel rollers.

The roller conveyor used for stockpiling at the plant of the Hankins-Paulson Company, Uniontown, Pa.

Need for Inclined Elevators

If the cured block is to be conveyed a considerable distance with gravity as the motive power it is of course necessary to have the receiving end of the conveyor a good bit off the floor of the drying kiln. This change of elevation can be accomplished by using an automatic inclined elevator. This is a portable machine used extensively in brick yards.



Flexibility with an overhead tramrail system, for handling concrete block

Concrete Manhole Block Business Growth

That the manufacture of concrete manhole and catch basin block has become an important branch of the concrete products industry is evidenced by the fact that 59 plants started to produce these units during 1928 and 1929. Prior to 1928 there were but 12 outstanding plants manufacturing these products in the entire country, with the principal business—about 3,000,000 units annually—in Chicago, Illinois. It is estimated that in 1929 about 5,000,000 units were produced in Chicago's metropolitan area.

Today, there are enterprising manhole block plants in nearly all sections of the country, the 59 new plants being distributed as follows:

Seven in New York state; 7 in Illinois; 6 in the New England States; 5 in Michigan; 5 in Washington state; 4 in Pennsylvania; 4 in Ohio; 4 in Wisconsin; 3 in Missouri; 2 in New Jersey; 2 in North Carolina; 2 in Indiana; 2 in Texas; 2 in California; and one each in Tennessee, Kansas, Colorado and Nebraska.

T. H. Merriam, also of the Cement Products Bureau, talked on merchandizing, his subject being "Expanding the Silo Market in 1930." Then, as a part of the discussion that followed, a star salesman of a concrete stave silo company related his personal experiences in making 133 sales during the past season.

Recent developments in curing methods for concrete products were brought to the silo men's attention by P. M. Woodworth, of the Cement Products Bureau. The program was concluded by an address by H. F. Gonnerman, manager of the Portland Cement Association's laboratory, and an inspection trip through this laboratory.

The manufacturers present were in Chicago attending the annual meeting of the National Silo Research Council. Features of this conference included addresses by the president, F. F. Rowell of St. Paul, Minn., and Prof. Paul Gerlaugh, director of Ohio Experiment Station, Wooster, Ohio.

NEW BOOKS

Concrete Plain and Reinforced

Concrete Plain and Reinforced, Vol. 2, 4th Edition. By the late Frederick W. Taylor, Sanford E. Thompson, and Edward Smulski. Published by John Wiley & Sons, Inc., New York, N. Y. Six hundred eighty-eight pages. Bound in cloth.

The contents consist of much entirely new material not found in previous editions. The volume covers the field of statically indeterminate structures. Continuous beams are exhaustively treated. Special treatment is provided for beams consisting of unequal spans. Material developed especially for the volume is contained in the chapter on building frames. Practical formulas on this subject ready to be used are said to be published for the first time here.

"Cement"

Cement. By Henry W. Nichols. Geology Leaflet 12. Published by the Field Museum of Natural History, Chicago, Illinois. 28 pages; 5½ by 8½ inches.

In words as simple as can be used, this leaflet tells of the discovery of portland cement, in considerable detail the manufactory and its branches, and the use of cement in concrete.

Curing of Concrete

A Discussion of the Purpose of Curing and a Description of Curing Methods

By LEE S. TRAINOR

"THE Five Requirements for Durable Concrete" are summarized by Dr. F. R. McMillan, director of research, Portland Cement Association, as follows:

(1) Durable, impervious aggregates.

(2) A watertight binding medium (the hardened cement—water paste).

(3) A mixture that permits complete incorporation of the aggregates in the paste.

(4) Methods of mixing and placing to secure a uniform homogeneous mass.

(5) Adequate protection and curing.

Much has already been said on the first four requirements as listed above and it is my purpose to confine this paper to the fifth requirement—adequate protection and curing.

Why Concrete Is Cured

Present knowledge of the behavior of portland cement concrete while setting and hardening indicates that under favorable curing conditions:

(1) A maximum amount of cement will be hydrated.

(2) The concrete will be subjected to a minimum amount of volume change during the period of low strength.

(3) Bond strength, watertightness, resistance to abrasion and other desirable properties of the concrete are materially improved.

There is evidence that when improper or inadequate curing conditions prevail:

(1) Insufficient hydration of the cement will be revealed through low strength of the concrete.

(2) Excessive cracking will result from the volume changes due to variations in temperature and in moisture content.

(3) Lack of durability of the concrete will be evident with the passage of time.

Practically all concrete as mixed and placed contains an excess of water over that required for hydration. The problem of curing, therefore, is essentially to prevent the loss of water through evaporation.

Concrete hardens as a result of chemical reactions between portland cement and water.

Favorable Temperatures Necessary

The continuance of these chemical reactions upon which the increase in strength depends, requires the continuous presence of water and favorable temperatures.

Temperatures that are regarded as favorable in practice range from 70 degrees F. to somewhat above 100 degrees F. The proportion of water actually entering into chemical combination with the portland cement may vary from as little as 5 to as much as 25 or 30 per cent of the cement by weight, depending upon the age and curing conditions.

The most favorable period for curing is during the first few days after the concrete has been placed and finished; however, if the full value of curing is to be realized a medium which provides for the continuous presence of favorable conditions over a long period of time must be employed. Continued curing increases the amount of combined water and reduces the amount of uncombined water thereby materially improving all the desirable qualities of the concrete.

Substantial sacrifice in strength and other desirable properties of the concrete will result if the mass is permitted to dry out at early ages and this loss cannot be regained or restored by subsequent moist curing.

The necessity for improvement over old methods of curing is very clearly pointed out by a review of existing data on the subject.

Some Opinions

F. H. Jackson and J. T. Pauls of the U. S. Bureau of Public Roads said in a paper presented at the seventh annual meeting of Highway Research Board, "There is probably no feature of the construction process so difficult to control as curing by means of water, due to the difficulty of maintaining an adequate supply over several days' run of pavement. Then, too, adequate supervision of the sprinkling operation is extremely difficult, which makes this feature an endless source of contention between the engineer and the contractor. It is evident, therefore, that there is a real field for a method of curing which will be as economical, more easily controlled, and at the same time just as efficient as the conventional method of applying water."

Speaking before the Constructors' Session of American Road Builders in Cleveland in January, 1929, George N. Childs said in part:

"The curing of concrete has a direct bearing on the length of time required before travel can safely be permitted. There has been a wide difference of opinion of engineers on this subject in the past; . . . The use of bituminous materials has been adopted in some states, and the results give promise of being very satisfactory. The cost of these materials is somewhat in excess of the old method of using earth, but the time gained and the reduced crew more than compensate for the loss."

Another evidence of needed improvement in curing practice as applied to concrete pavement is given in A. Stellhow's paper before the last meeting of American Road Builders' Association.

"There is so much difference of opinion and such a variation of practice in curing concrete that unless some extremely unusual method is employed all the contractors can do is to allow a reasonable figure for the cost and then satisfy the engineers.

"As far as saving for the contractor is concerned, any method which will accomplish the curing quickly is desirable, even though the first cost is somewhat high.

"There is usually more bickering and misunderstanding about the curing of a concrete pavement than all the other operations combined."

A paper presented at 35th annual meeting of the American Society for Municipal Improvements, Philadelphia, October, 1929.

George B. Sowers, deputy commissioner of Engineering and Construction, Cleveland, Ohio, is quoted in 1929 proceedings of American Road Builders as follows:

"Many of the methods adapted to the curing of concrete roads in rural sections can not be used in city streets. Ponding, earth covering or straw covering are some of the methods not practical in cities for obvious reasons.

"In the downtown sections it is impossible to cover the pavement with earth and keep it moist for sufficient time to properly cure the concrete."

Low Porosity

Other evidences of the necessity for a better understanding of the behavior of portland cement concrete and the bearing of proper and adequate curing upon the ultimate life and durability of the structure is contained in the 1929 proceedings of American Concrete Institute wherein emphasis is placed upon the necessity of producing a concrete of low porosity to resist the destructive forces of external conditions other than loads, as for example the action of frost, the change in temperature, etc.

It is recognized that proper and adequate curing will substantially reduce the permeability of concrete, thereby affording a greater resistance to the disintegrative forces to be dealt with.

Surface Coatings

Substantial improvement in curing practice has been made with the introduction of surface coatings which are applied to the exposed surface of the freshly finished concrete. Especially prepared compounds composed chiefly of processed natural asphalts and gilsonite, blended at high temperatures, are now available on the American market and their principal points of superiority as curing agents when applied to unset concrete are:

(1) Seal the surface of the concrete, preventing loss of original mixing water through evaporation;

(2) Eliminate hair checking and other surface cracking;

(3) Provide a dense, wear-resistant surface;

(4) Protect freshly finished concrete from damage during sudden showers;

(5) Eliminate the use of burlap;

(6) Remove the necessity for sprinkling and spraying with water during the period following the finishing;

(7) Do not require the use of earth, straw or other moisture retentive coverings.

To satisfactorily meet the requirements of good curing the materials used to seal the surface of the concrete must possess the following characteristics:

(1) Must adhere to and completely seal the wet concrete with one coat when sprayed over the surface immediately after the final belting and finishing.

(2) Must dry to the touch within two hours and be hard and firm within twenty-four hours after application.

(3) Shall not contain more than one-half of one per cent of water.

(4) Must be of a consistency that will permit application without heating when used at any temperature ordinarily considered favorable for the placing of concrete.

(5) Must be of such a nature that it will not penetrate the surface of the concrete nor produce any chemical reaction within the concrete.

(6) Must possess the property of retaining moisture in the mass over a long period of time, thereby assuring the maximum hydration of cement through continuous curing with its attendant increase in the amount of combined water.

Preservative Treatments for Stone Increase Resistance

Although preservative treatments for stone have been used for a considerable period of time, their value has often been questioned. The type of preservative most frequently used in this country consists of a wax of stearate dissolved in a volatile solvent which is applied to the masonry with a spray or brush, the Bureau of Standards, Department of Commerce states. This solution penetrates the pores of the masonry, and as the solvent evaporates the wax is left in the pores, forming a more or less effective seal. The preservative effect is supposed to be gained by preventing a penetration of moisture, thus overcoming the action of frost or other harmful effects which may result from dampness inside the masonry.

It has been proved that such treatments do not entirely seal the surface pores of stone, and for this reason there has been considerable doubt concerning their value, especially where the stone is subjected to abnormal amounts of dampness. The theory is sometimes advanced that, to seal or partially seal the surface pores when water can penetrate through or behind the treatment will cause a condition under which the stone will decay from frost action at a more rapid rate than if the surface pores were left open. Since frost action on stone is the result of expansion of water in passing from the liquid to the solid state, this theory seems to be entirely sound for masonry exposed to very damp conditions where the material can become highly saturated; because the treatment would seem to hinder or prevent the extrusion of ice through the surface pores, and hence higher internal stresses would develop than if there were no surface seal.

In order to test this theory, some experiments have recently been made at this bureau on parallel series of stone specimens, one of which was treated with a 10 per cent solution of paraffin in benzol and the other left in the original state. Two sandstones and two limestones were selected for the experiments, all of which were known to have rather low resistance to frost action. After treating half the specimens of each kind with the preservative the two series were soaked in water for 14 days and absorption tests made during this time after periods of 30 minutes, 24 hours, and 14 days. While all of the treatments were indicated to be effective to the extent of greatly reducing the rate of absorption, at the end of the 14-day period the treated specimens had absorbed from 68 to 95 per cent as much as the untreated specimens. The two series were then placed in ½ in. of water in a tray and placed in the freezing chamber until frozen, after which they were taken out and thawed in water at room temperatures. This cycle was repeated until the specimens were all disintegrated.

Treatment Protects Against Frost

In these experiments all of the treated specimens showed higher resistance to frost than the untreated ones. The increased resistances computed as a percentage of the number of freezings required to disintegrate the treated material were as follows: One sandstone was improved 350 per cent, another 260 per cent; one limestone was improved 190 per cent and the other 53 per cent.

These experiments indicate that such a preservative treatment is of value on the types of stone under consideration even under very severe conditions of soaking. It also seems probable that where such stones are placed in the walls of a building and exposed only to the intermittent soaking of rains or thawing snow that the treatments would be far more effective than indicated by these experiments.

Concerning Admixtures

Some Opinions Regarding the Value of Admixtures in Concrete

By **ROY CROSS**
Kansas City Testing Laboratory

THERE has been a tendency recently to treat the use of admixtures in concrete as a new idea. As a matter of fact, among engineers and chemists who have followed or studied carefully the development of hydraulic cements and concretes there has always been a widespread interest in powdered admixtures. The first hydraulic cements used were merely combinations of volcanic siliceous materials and lime. Such siliceous materials, therefore, have always been considered by chemists and engineers as suitable admixtures in portland cement concrete and mortars.

An Early Paper on Admixtures

One of the earliest, if not the earliest, article relating to the use of admixtures in connection with American-made portland cements was presented before the American Society of Civil Engineers by Andreas Lundteigen, April 7, 1897. It is well worth while to quote the opening statement made by Mr. Lundteigen in this paper:

"A number of years ago the Society of German portland cement manufacturers published an article claiming that good portland cement could not be improved by admixtures. It seems likely that the purpose of that article must have been to counteract any endeavor by dishonest men to add poor admixtures, and thus lower the reputation of German portland cement, which then had begun to invade the markets of the world. It is also possible that experiments with many cements made before that time would not show the advantage of fine siliceous admixtures, as well as the present high-limed and high-testing cements. Besides it may also be that both good and valueless admixtures were treated under one head, and therefore condemned."

There has been a tendency, of course, for engineers particularly to treat the use of admixtures from a strictly physical standpoint; while as a matter of fact other elements enter into the matter than questions of physical relation. Mr. Lundteigen pointed out in his paper thirty-two years ago that, under the hydration and hardening of cement mortar, "a part of the lime is continuously set free or separated from its molecular combination with the silica, alumina or iron; or, in other words, these last substances are able to combine with more lime and magnesia in a dehydrated state in the kilns than in a hydrated state in the mortar. Dr. Michaelis finds that about 33 per cent of the hydrate of lime in the average portland cement is set free and will seek other material to combine with. If reached by the air it will take up carbonic acid and form a carbonate, which does not injure the concrete; in pure water it will be washed away in the water, and the concrete will be left more porous and weaker; in sea-water, or water containing mineral salts, these salts will combine with the calcium hydrate and form voluminous double salts, which will swell and destroy the concrete. Gerhart Herfeldt discusses this same subject, and shows, like Dr. Michaelis, how portland cement can be improved by admixture of trass."

In short, the article by Mr. Lundteigen shows that in almost all types of mixtures with sand the use of some type of volcanic silica, trass or the like is definitely beneficial to cement. As an illustration of this effect, the following table of various tests made by Mr. Lundteigen is extremely instructive.

EXTRACTS FROM "NOTES ON PORTLAND CEMENT CONCRETE"
Presented by
ANDREAS LUNDTEIGEN, April 7, 1897
Transactions American Society of Civil Engineers No. 807

Mix	Tensile Strength—lbs. per sq. in.						
	7 da.	28 da.	6 mo.	1 yr.	2 yr.	3 yr.	4 yr.
1. 1 part cement 3 parts sand 12% water	77	136	264	298	—	—	—
2. 1 part cement 1 part volcanic silica 3 parts sand 14% water	33	100	341	470	582	628	—
3. 1 part cement 1 part volcanic silica 5 parts sand 12.8%	40	125	314	374	—	470	—
4. 1 part cement 1 part volcanic silica	95	154	373	546	676	—	715
5. 1 part cement 2 parts volcanic silica	42	84	262	474	493	—	574
6. 2 parts cement 6 parts sand	129	183	293	366	265	—	265
7. 1 part cement 1 part volcanic silica 6 parts sand	27	92	213	422	473	509	499
8. 1 part cement .5 part lime (partly slaked) 4 parts sand	154	88	Disintegrated			—	—
9. 1 part cement .5 part lime (partly slaked) 1 part volcanic silica 8 parts sand	36	64	168	—	193	—	—
10. 1 part cement .2 part lime (partly slaked) 1 part volcanic silica 6 parts sand	41	107	492	—	548	—	—
11. Neat-cement	464	601	—	882	906	—	978

There are several important things to be noted about these tests: first, that the use of the admixture as a replacement at first reduces the strength, later greatly increasing it and, finally, exceeding in most cases the strength of the cement itself. These tests are excellent illustrations of the practical value of the reaction of the available lime with volcanic silica. The volcanic silica used by Mr. Lundteigen in these tests came from the volcanic ash such as is found in great quantities in Nebraska, western South Dakota, Wyoming, Colorado and other places. The chemical composition is very similar to that of Santorin earth from Greece and trass from Germany, as well as the volcanic bentonite materials in western South Dakota, Wyoming, California and Nevada. Such materials of volcanic origin react to take up the excess of lime developing during the hardening and setting of cement.

Data of this sort, which has been widely published in the past in Germany and European countries, has not been so familiar to American engineers and there has been a tendency on the part of some engineers who are not fully conversant with these facts to underrate the value of powdered admixtures and to draw conclusions that are not entirely justified in view of the facts divulged by other experimenters or even some of their own experiments. Pre-eminent among some of the recent papers on this subject is one published as a reprint from the Proceedings of the American Society for Testing Materials by Duff A. Abrams of the International Cement Corporation of New York City. Abrams' tests are made largely from the standpoint of the engineer rather than from the standpoint of the chemist. The conclusions of Abrams are possibly misleading, in view of his own experimental data, principally for the following reasons:

(1) Comparisons were not made on the basis of the same water-cement ratio. If a comparison is to be made with different cements, the most appropriate basis should be with the identical water-cement ratio; and the same statement should apply to the use of admixtures.

(2) The optimum quantity of the admixture was not determined in each case and in many cases the desirable quantity was not used. Various amounts were selected purely arbitrarily and comparisons were not made on the basis of the effect of different quantities of admixture on the workability of the concrete.

(3) The tests were designed in such manner that the admixture was used to replace the cement. Ordinarily this is not recommended, although the right kind of admixture, properly selected or compounded, will often permit of the replacement of cement to a very considerable degree in certain classes of concrete work.

(4) The slump test and the flow table are generally acknowledged by most engineers and chemists to be unsatisfactory as measures of workability.

(5) Apparently no determinations were made relative to the volume of concrete produced with a fixed weight of materials. If any bulking resulted, apparently the amount was not determined.

Inter-particle Friction

One of the most important elements relative to the handling of concrete is the inter-particle friction; that is, the friction between the pieces of aggregate in the mix. Anything that will reduce this inter-particle friction will improve the workability of the concrete. It is perfectly obvious that the slump test is not a measure of inter-particle friction. A slump test on dry aggregates such as standard sand, river sand, bank sand, crushed rock and the like is between 6 and 9 inches. Such a slump test with dry materials certainly does not indicate that they are easily workable in that state. If water is substituted for air as the carrying medium for the aggregate, there is not much improvement; if a cement paste is substituted for air or the water, there is, of course, some improvement, but the improvement is not sufficient if the rock particles are allowed to be in contact with each other. One of the physical purposes of an admixture, therefore, is to prevent the particles of aggregate from actually rubbing against each other, just as a film of lubricating oil is used to prevent a rotating shaft from coming into too close contact with its bearing. Every particle of aggregate should be coated with a lubricating film incorporating the portland cement.

If the internal friction of a mass of concrete is measured by the amount of work required to pull a paddle or shovel through the concrete, then it is immediately apparent that the slump test is not proportional to the work necessary. That the slump test and the flow test are not proper measures of workability or plasticity is rather generally conceded by impartial engineers.

The slump test, of course, is of use on each particular job as a means of maintaining uniform conditions with the same materials. There are cases where a 7-inch slump might be desirable or necessary and other cases where a 1½-inch slump is perfectly satisfactory. In some instances, certain harsh materials cannot be properly placed without the use of suitable admixtures, regardless of the slump. In other cases, where concrete may be handled satisfactorily without admixture with a 7 or 8-inch slump, it may be handled more satisfactorily with a 3-inch slump with a proper admixture and a proper use of the admixture.

Increased Strength

An examination of Abrams' data in the paper above referred to ("Proceedings" of the American Society for Testing Materials, Volume 29, Part II, 1929) on the basis of the same water-cement ratio, and picking out a type of admixture that in Abrams' conclusions are stated to be most injurious, may be tabulated as below. It is to be noted that in practically all instances the use of bentonite increased the compressive strength, with the same water-cement ratio and, in one instance, with the cement replaced by the bentonite and with a higher water-cement ratio, there was an increase in strength of nearly 10 per cent. In view of such tests as these it seems inconsistent to say that bentonite has had an injurious effect.

TESTS OF POWDERED ADMIXTURES IN CONCRETE

By Duff A. Abrams

Comparison of Tests With and Without Bentonite

Reference Number	41	67
Bentonite	None	2 lbs. (3%)
Cement—lbs.	68	66
Mix	1:1.7:3.0	1:1.7:3.0
Water-Cement ratio	0.93	0.95
Slump	6″	2¼″
Compressive Strength, 28 day—lbs. per sq. in.	4,210	4,600

The above test shows an increase in compressive strength of about 10 per cent when 2 pounds of bentonite is used replacing the cement and with a slight increase in water, with the concrete otherwise the same.

Reference Number	5	8	18	24
Lbs. cement	47.5	47.5	47.5	47.5
	(Standard)	(Standard)	H.E.S.	H.E.S.
Admixture (Bentonite)	None	5%	0	5%
Water-Cement Ratio	1.01	1.01	0.96	0.93
Slump, inches	7½	2¼	8	2¼
Compressive Strength Lbs. per sq. in.				
1 day	470	530	1,250	1,600
2 days	980	1,120	2,410	2,600
3 days	1,300	1,520	2,660	2,850
7 days	2,020	2,120	3,470	3,610
28 days	3,100	3,230	3,780	4,050
3 months	3,910	3,740	4,420	4,480

What Are Admixtures?

The term "admixture" has been applied to a variety of substances having considerable variation in properties, but in general it is applied to powdered admixtures that are designed to improve the handling of the concrete. Possibly the following outline sets forth to some degree, in the order of importance, the various features that must be characteristic of acceptable admixtures:

(1) The admixture should have the property of imparting improved workability to the concrete. This would include the reduction of labor costs, the reduction of material-handling costs, more satisfactory transportation and faster work. The value of an admixture from this standpoint is ordinarily measured by experience.

(2) The admixture should result in better concrete in terms of uniformity of the mixture, lack of segregation, greater watertightness, absence of patching and beauty and perfection of finish.

(3) The admixture should impart all possible desirable properties with a minimum quantity of material. In other words, there should be a minimum replacement of cement with a maximum effect per pound of admixture. For example, plasticity should be imparted with the smallest amount of material per sack. An admixture giving the desired plasticity with the use of one pound per sack is better than one that requires five pounds per sack for the same result.

(4) The admixture should not have any deteriorating effect on the concrete. It should preferably, with the same water-cement ratio, increase the strength. This should be accomplished, if possible, by overcoming any undesirable features of portland cement; for example, such as the release of lime during hydration and hardening. The admixture should improve the soundness of the cement, mortar or concrete with which it is used. Certainly in no case should it have any deteriorating effect either as to strength, soundness or waterproofing qualities.

(5) The admixture should be available at a cost that will not materially increase the cost of the concrete. Entering into this feature, of course, is the saving in handling costs, the elimination of repairs, and the yield of the concrete. The yield should be a secondary consideration, but there is no objection to this if the other desirable features are maintained.

Design Details of a French Reinforced Concrete Bridge

Examples of some of the reinforced concrete bridges in France date back about forty years, and many engineers may be surprised to learn the sizes and spans of some of the modern structures now being erected in that country. Between Annecy and Geneva is the Pont de la Caille, a main-road suspension bridge with a span of about 600 ft. over a gorge 480 ft. deep. On a site lower down the gorge, and to replace this old construction, a new reinforced concrete bridge is being built, the general design of which consists of a single 450 ft. arch span with a short approach viaduct on either side.

The main arch is of the usual fixed or encastre type, with the difference that, owing to its scantlings, no longitudinal tensile stresses are produced anywhere in the arch. No longitudinal rods are therefore necessary, and no such longitudinal reinforcement has been introduced. The construction of the new bridge was carried out to the following program: The contractors first put up an aerial transporter across the gorge having a span of about 600 ft. The short viaduct on either side of the bridge was constructed first, together with the enormous piers, which rise above the springings to the main arch. These piers are solid to about one-third of their height, after which they are of hollow construction stiffened by cross diaphragms. To allow the ends of the viaduct to move in conformity with temperature variations, the front and back walls of the piers are slotted downwards for about 20 ft.

The main beams of the viaduct are rigidly attached to these flexible walls at the back of the piers, and the deck slab carrying the roadway over the main span will be similarly attached to the front walls. When the main piers had been concreted, timber frames were built on top of them to support a series of cables spanning the gorge. These cables pass on concrete saddles over the top of the timber supports, and are anchored back to concrete blocks on either side of the roadway. To these cables are attached vertical suspenders fixed at their lower ends to a series of timber joists on which the first working platform was built, the curve of the main cables and the lengths of the verticals being adjusted so that the work corresponded roughly to the curve of the main arch, but at a distance of about 15 ft. below it.

The concrete anchor blocks were cast with loop bars projecting from them, and concrete circular blocks about 8 in. in diameter were inserted, and around these blocks the ends of the main cables were secured. A secondary loop projecting from the anchor block allowed of a turnbuckle being attached, by which each cable could be tightened and its length adjusted. The strength of the temporary cables and suspenders supporting the cross joists and working platform was not sufficient to carry the deadweight of the whole of the timber lattice centering, but the detail design of this centering was so arranged that each successive operation during its construction added sufficient strength for the next portion to be proceeded with. Thus, when the working platform was finished, it was strong enough to carry two lines of longitudinal timbering, consisting, in each case, of three balks, 14 in. by 7 in., separated by chocks at intervals, thus leaving spaces for the diagonal timbers to be inserted.

The ends of the timbers in these longitudinals were kept about 2 in. apart, and the spaces between them filled in with cement fondu over the whole surface area. At occasional intervals the ends of the timbers were shod with metal and large folding wedges introduced at these points so that the amount of thrust taken by each member could be controlled. The effect of the addition of these two longitudinals was to stiffen the platform in both the horizontal and vertical directions, and also by acting as an arch to strengthen it, so that it would bear the additional weight of two more series of longitudinal timbers. The diagonals forming the lattice webs were then built up and top booms, constructed of timbers, in the same manner as for the bottom members, were added. When a timber platform had been fixed over the top booms the resultant arch was found to be extraordinarily stiff.

Since the top surface of the centering was to form the soffit of the permanent arch, the timber planking was screeded with weak concrete to the final curve. By this means, the entire centering was constructed on cables, which were not capable of taking more than about one-third of the deadweight. The temporary centering having been constructed as described, the precast members of the bottom vault were carried out on the aerial transporter, lowered on to the centering and carefully spaced in the predetermined positions. In order to avoid the possibility of distorting the centering, the greatest care had to be taken to load it symmetrically. The concrete between the precast sections was then deposited, being carried out in a skip on the transporter. Some difficulty was experienced in concreting the sections near the springings, owing to the slope of the arch. A grouting plant was therefore kept on the job and applied to each section in order to fill up any voids that might have been left.

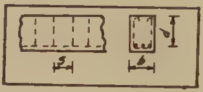
Reinforced Concrete Design Simplified

Chart F_1 (16,000)
Stirrup Spacing

By **JAMES R. GRIFFITH**
Professor of Structural Engineering, Oregon State Agricultural College

American Concrete Institute Building Code

$f_s = 20{,}000$ lbs. per sq. in.
$f_v = 16{,}000$ lbs. per sq. in.
$f'_c = 2{,}000$ lbs. per sq. in.
$n = 15$
Without Web Reinforcing
$v = 40$; 60 lbs. per sq. in.
With Web Reinforcing
$v = 120$; 180 lbs. per sq. in.
$f'_c = 2{,}500$ lbs. per sq. in.
$n = 12$
Without Web Reinforcing
$v = 50$; 75 lbs. per sq. in.



With Web Reinforcing
$v = 150$; 225 lbs. per sq. in.

$$s = \frac{16{,}000\, A_v}{v'\, b}$$

IN Chart F of the original series the allowable stress in the stirrups was taken as

$$f_v = 18{,}000 \text{ lbs. per sq. in.}$$

The allowable unit shear carried by the concrete was specified at

$$v = 40 \text{ lbs. per sq. in.}$$

Since the steel stress was to be changed to

$$f_v = 16{,}000 \text{ lbs. per sq. in.}$$

it was considered advisable to permit more variation in the allowable shear to be carried by the concrete. On Chart F_1 (16,000) I have changed the shear scale to read "Excess Unit Shear." Thus the allowable unit shear must be deducted from the total unit shear at any section before using the chart.

Application of Chart F_1 (16,000)

Under Chart F of the original series, a problem was solved with the following conditions given:

Breadth of Beam = 16 inches
Effective Depth = 25 inches
Unit shear at end of beam = 51.4 lbs. per sq. in.
Unit shear one ft. from end = 47.2 lbs. per sq. in.

The solution isopleths on Chart F gave the following stirrup spacings:

End of beam, $s = 9.8$ in.
One ft. from end, $s = 15.2$ in.

The solution of these same conditions for the lower unit stress in the stirrups is shown by the three solution isopleths on Chart F_1 (16,000). Isopleth (1) is drawn through a ¼-in. round "U" stirrup and the breadth ($b = 16$ in.). Isopleth (2) is drawn from the excess unit end shear of ($v' = 51.4 - 40 = 11.4$) and the intersection of isopleth (1) and the support. Isopleth (2) gives a stirrup spacing of

$$s = 8.7 \text{ in. at end of beam}$$

By formula

$$s = \frac{16{,}000 \times 0.1}{11.4 \times 16} = 8.77 \text{ in.}$$

Isopleth (3) gives a spacing of stirrups of

$$s = 15.2 \text{ in., 1 ft. from end}$$

The A. C. I. Code specifies "Where the shearing stress is not greater than $0.06\, f'_c$ the distance (s) between two successive stirrups measured perpendicular to the direction of the stirrup shall not exceed ¾ d, and where the unit shearing stress exceeds $0.06\, f'_c$ it shall not be greater than ⅜ d." In the problem being considered

$$0.06\, f'_c = 0.06 \times 2{,}000 = 120 \text{ lbs. per sq. in.}$$

So the maximum stirrup spacing would be

$$\text{Maximum } s = \tfrac{3}{4}\, d = \tfrac{3}{4} \times 25 = 18.75 \text{ in.}$$

In practice the stirrups would probably be located with two spaces at 8 in. and two spaces at 12 in., as Fig. 1-F_1.

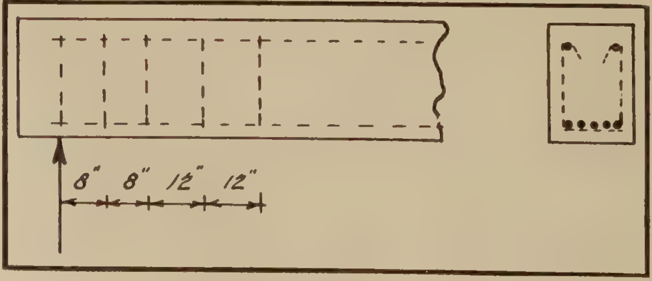


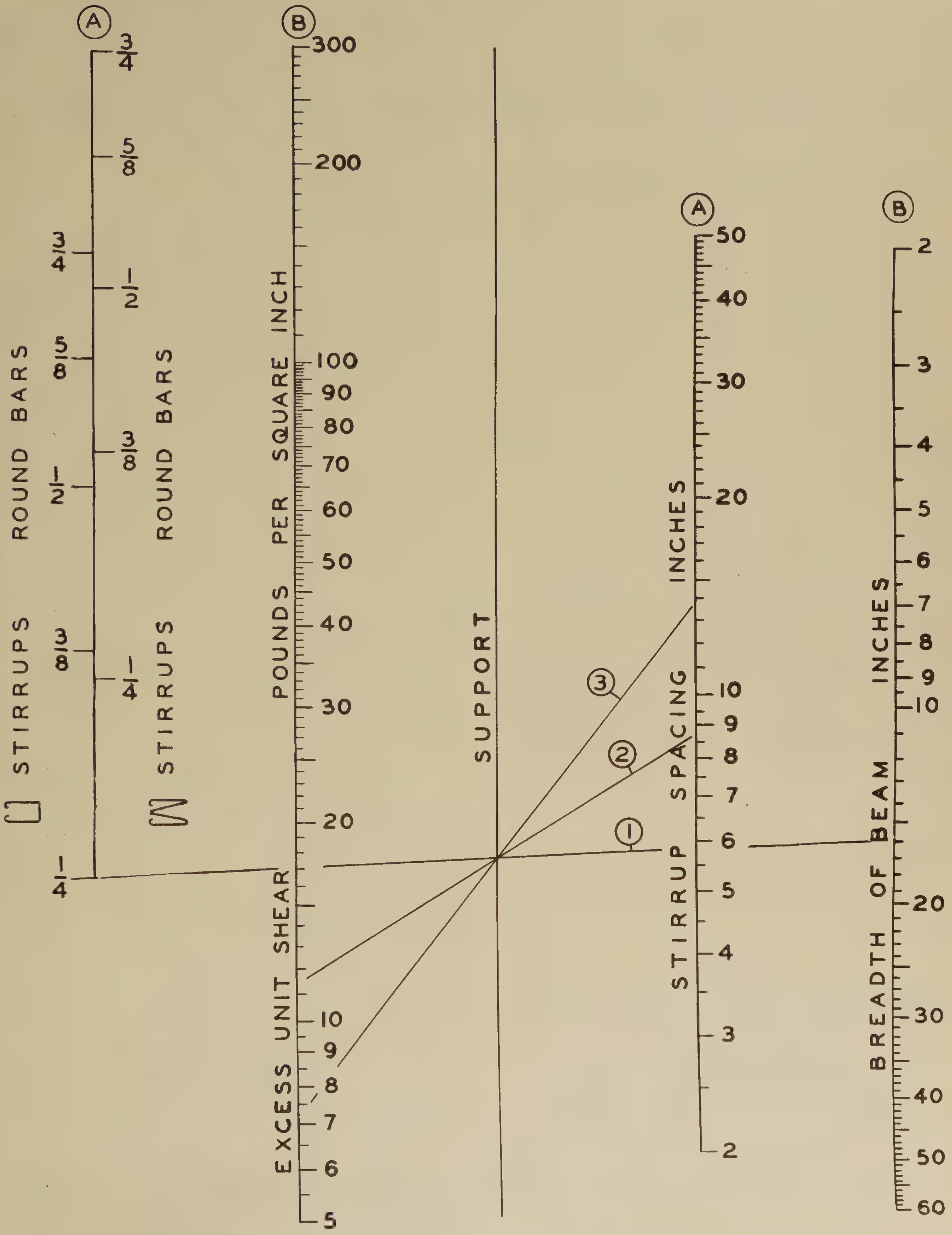
Figure 1-F_1

Mr. Lord has presented with the A. C. I. Code a set of curves for determining the stirrup spacing making all stirrup spacings vary. While theoretical variable spacing looks good in figures and on the drawings, I question the reaction of the construction men to such spacing.

CHART F₁ (16,000)

Stirrup Spacing

f_s = 16,000 lbs. per sq. in.



A. C. I. Code Requirements

The building code of the American Concrete Institute specifies

"Area of steel required in stirrups shall be computed by formula

$$A_v = \frac{V' s}{14{,}000\, d}$$

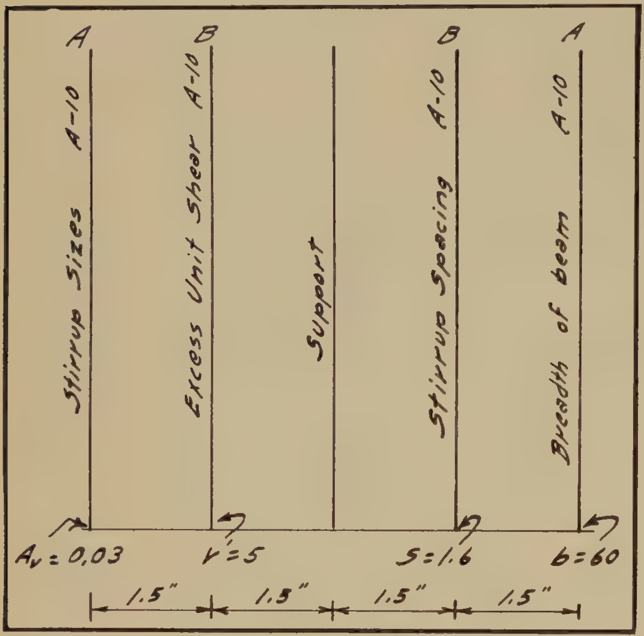


Figure 2-F_1

A_v = Area of the stirrup, sq. in.
d = Effective depth of beam, inches.
V' = Excess of total shear over than permitted on concrete, pounds.
s = Spacing of stirrups, inches."

A chart similar to Chart F_1 (16,000) could be prepared for the equation in the above form, but would be objectionable due to the wide range of values for V'. Since the unit shear is always the determining factor in web reinforcing, this equation has been changed to one in terms of the unit shear. Transposing the A. C. I. formula to the form

$$s = \frac{14{,}000\, A_v\, d}{V'}$$

and substituting

$$V' = v' b j d = v' b \frac{7}{8} d$$

I get

$$s = \frac{16{,}000\, A_v}{v' b} \qquad \text{Eq. 1-}F_1$$

This is the same form used to construct the original Chart F except that the A. C. I. Code specifies that the unit stress in the stirrup shall not exceed

$$f_v = 16{,}000 \text{ lbs. per sq. in.}$$

In Chart F a stirrup stress of 18,000 was used.

Construction of Chart F_1 (16,000)

When constructing the original Chart F I used

$$v' = v - 40$$

In this chart I have plotted (v'). Otherwise the scale sizes used and the relative distances between scales are the same as explained in the original series. Fig. 2-F_1 gives the complete information by which the original of Chart F_1 (16,000) was constructed. I have omitted the scale giving the area of the stirrup steel and have shown only the location of the various stirrup sizes in common use.

Pavement Temperatures Under Straw Cover in Freezing Weather

Pavement temperatures taken on two streets in Maysville, Kentucky, indicate that straw covering has considerable value as a protection against freezing, even when the concrete materials are not heated. They also indicate a much greater fluctuation in temperatures outside the covering material than under it, and that cold spells of short duration do not greatly reduce the temperature under the covering.

Method of Testing

Two thermometers, properly calibrated, were used in taking the temperatures. One was laid on the pavement under the covering and the other was placed on top of the covering. The covering consisted of one thickness of burlap, laid directly on the pavement, and a 6-inch layer of loose straw which was spread uniformly over the burlap.

On Lexington Street the lowest temperature observed outside the covering was 26 degrees above zero; at that time the temperature under the cover was 40 above. And while the lowest outside temperature was 12 degrees below the average outside temperature, the lowest under the cover was only 7 below the average, which indicates the smaller range of temperature change under the cover. This is still more strikingly illustrated by the highest outside temperature, which was 52, or 15 degrees above the average, while that under the cover was actually less than that outside, having risen to only 50, or 3 degrees above the average.

Temperatures on Commerce Street show similar results but the range of temperatures was less, so the effect is not so evident.

Results of Test

Although the records are not sufficiently extensive to warrant any definite conclusions, they do indicate that a straw covering will protect a pavement from temperatures slightly below freezing if those temperatures are of short duration.

LEXINGTON STREET

Station	Date	Time	Temperature Outside Cover Deg.	Temperature Inside Cover Deg.
4 50	11/10	7:00 A. M.	35	46
4 50	11/10	11:30 A. M.	38	50
5 00	11/10	4:30 P. M.	35	48
5 00	11/11	6:30 A. M.	26	40
6 50	11/11	4:30 P. M.	36	46
7 00	11/12	7:00 A. M.	28	40
7 00	11/12	12:00 M.	52	50
7 00	11/12	4:30 P. M.	42	50
7 00	11/16	7:00 A. M.	44	50
7 00	11/16	12:00 M.	42	50
7 00	11/16	4:30 P. M.	38	50
Mean Temperature			38	47

COMMERCE STREET

Station	Date	Time	Temperature Outside Cover Deg.	Temperature Inside Cover Deg.
4 50	11/4	4:00 P. M.	44	44
4 50	11/5	7:00 A. M.	37	45
4 50	11/5	1:00 P. M.	57 (Sunshine)	60
4 50	11/5	5:00 P. M.	50	59
2 50	11/6	7:00 A. M.	36	46
2 50	11/6	5:00 P. M.	44	49
1 50	11/7	7:00 A. M.	43	46 (burlap only)
Mean Temperature			45	49

Concrete for the Builder

Selling Industrial Driveways

Every Industry Needs Durable Pavements in This Day of Motor Trucking and Fast Deliveries

IN this day of motor trucking and fast deliveries, the efficiency of hauling and trucking operations around any industrial plant demands that driveway pavements be durable, mudless, dustless, wearproof and economical in all kinds of weather. Recognizing this fact and appreciating that it is of value from the standpoint of new business, aggressive concrete builders are selling concrete pavements to industrial concerns.

How to Find Prospects

There are various prospects in the market for industrial driveways, including those in charge of construction work for produce and wholesale terminals, coal and material dealers, docks and wharves, railroads and manufacturing plants. One of the principal sales arguments used by concrete builders who are going after industrial driveway business is that the widespread use of concrete for highways, city streets and alleys has established it as the most economical and satisfactory pavement material. These builders are also showing prospective buyers of industrial pavements that concrete can be designed for any conditions of loading, that it is in general demand for industrial driveways and that it is inexpensive to maintain.

The builders who are now getting driveway business from the industrial plants in their respective communities have learned to stress some of the other outstanding advantages of concrete as a material for building driveways. These important sales points are that concrete provides good traction with low tractive resistance, increases the value of property, eliminates the hazards of unpaved yards, insures safe and certain delivery in all kinds of weather, and that concrete promotes cleanliness. In fact, aggressive builders have many facts at their disposal which can be used to prove that concrete has more desirable qualities for industrial driveways than any other material.

Progressive concrete builders not only are able to build concrete pavements that will meet almost any requirements but they are acquainted with the reasons why concrete is best suited for building driveways for any particular branch of industry. Being acquainted with these reasons enables the builders to do personal selling that brings profitable results.

Sales to Coal and Material Dealers

Dealers that handle coal and building materials are some of the leading prospects for industrial driveways. Countless coal and material yards already have concrete pavements, but there are just as many more that are still struggling along trying to make prompt deliveries under the handicap of unpaved yards. One of the largest coal and material companies in Chicago, for example, has let contracts to pave nearly all of its city and suburban yards with concrete. This company handles an enormous tonnage and knows that a large saving has been effected at its yards where concrete has been used to replace out-of-date plank driveways. Dealers in other large cities and small towns as well have learned that moving their loads over concrete paved driveways is good economy. Concrete builders who sold these jobs undoubtedly were alert salesmen. They were able to prove that much time is lost and that costs run high when an unpaved yard is hub deep in mud. Certainly, they were able to show the dealers that with a dependable concrete pavement there is no delay in getting to and from bins and cars no matter what the weather may be. An added advantage of concrete pavements which can be used as a sales aid is that freight cars can be speedily unloaded and promptly released. Likewise, accurate selection and prompt deliveries are always possible in lumber and material yards where orderly stock piles flank smooth, clean concrete driveways. Another and very important sales argument now being used by concrete builders is the fact that paved yards invite business and help coal and material dealers to gain and retain customers who appreciate prompt, satisfactory service.

Produce and Wholesale Terminals

A pavement with an even surface free from hollows and ridges is an important advantage for produce and terminal districts, because it is easily kept clean. So states the concrete builder when he sells his services for this kind of work. In produce and wholesale terminals, facilities for rapid movement of large volumes of traffic are necessary. Concrete contractors have an opportunity, therefore, to prove that dependable concrete can play an important part in caring for this traffic. Many of them are taking advantage of this opportunity and are using aggressive selling to get more driveway business.

Manufacturing Plants Need Driveways

Soon after reading the following statement in a magazine devoted to industrial problems and facts about industry, the superintendent of a large manufacturing plant was interviewed by an aggressive concrete builder:

"The ideal driveway surface is one that is most nearly permanent, so that the heaviest and most destructive traffic will have little or no effect upon it. It also presents the least resistance to load movements, is not slippery in wet weather, is dustless, drains quickly, is not excessive in

(Continued on Page 51)

Building Industrial Driveways

Instructions Covering Methods for Constructing Concrete Pavements for Industrial Traffic

The elevation of the pavement should place wagon and truck bodies at the level of the platforms or car doors.

Vehicle lengths will govern the width of pavement and the inside radii of turns. Where possible, these radii should never be less than 20 ft.

Allow for the overhang of large trucks and the tracking of the rear wheels.

The pavement should have good drainage. Provide sewer connections where surface drainage is inadequate.

Foundation on which concrete is laid should be uniform, whether hard or soft. Any ruts or hard ridges should be roughened and re-rolled.

Build the pavement thick enough and strong enough to carry the heaviest loads safely.

See that the quantity of mixing water is carefully controlled.

Place the concrete carefully and finish it to an even, smooth surface.

Keep the pavement damp while the concrete is hardening.

BUILDING driveways and paved yards for industrial traffic is work that the average concrete contractor can do with his ordinary equipment. If the driveways are built for some of the larger industrial concerns, the buyers probably will specify the thickness of slab needed, proportions of materials and the general layout for the work. However, the concrete builder is frequently called upon to work out these specifications and details for work being done for coal and material dealers and others who do not maintain engineering or construction departments. It is important, then, that the concrete builder who is going after industrial driveway business should know how to build pavements for typical requirements.

Thickness of Slabs

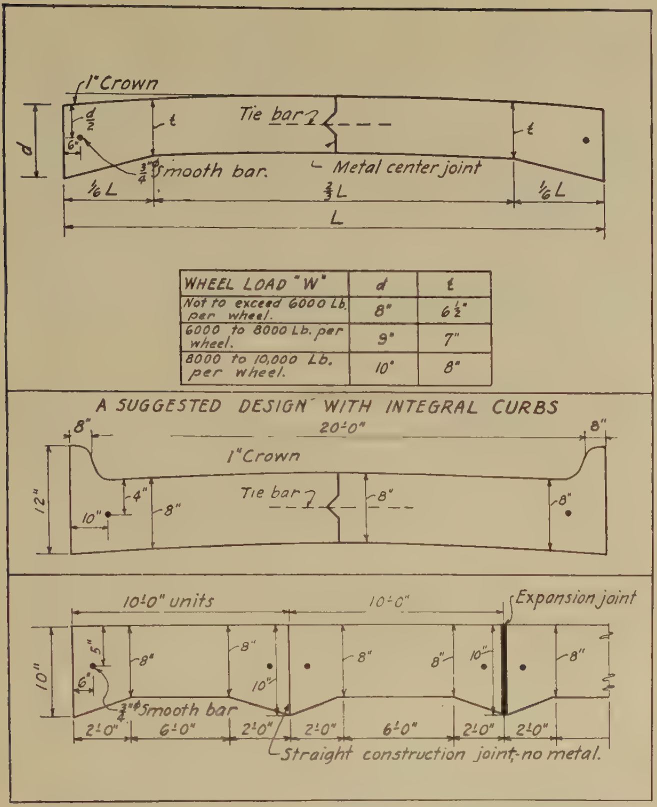
In building a driveway for industrial traffic, the thickness of slab is one of the most important considerations. That is, a driveway built according to sidewalk specifications can not be expected to give satisfactory service under heavy industrial traffic. The concrete builder can, however, be guided by the following in determining thickness of slabs:

For ordinary automobiles and for trucks of three tons capacity or less, a 6-inch slab would be sufficient. This thickness is not generally recommended even for filling station driveways, however, because it is highly probable that heavier trucks will be driven over the concrete. So long as the truck wheels do not come within 2 feet of the edge of a driveway, a 7-inch concrete slab will support a full loaded 5-ton truck. When it is possible for the wheels to come within 2 feet of the edge, the pavement along the edge should be made 9 inches thick. To obtain this thickness, a curb can be constructed as a part of the pavement, if a curb is wanted by the buyer of the driveway, or by making the subgrade 2 inches deeper along the edge than it is in the interior portion of the slab. An 8-inch pavement slab with integral curbs is shown in an accompanying drawing.

Concrete pavement in railroad freight yard at Seattle, Washington

Concrete driveway used for heavy trucking at the Sears, Roebuck & Company plant at Port Newark, New Jersey

Where 7-ton trucks will use the driveway regularly, the slab should be 8 inches thick with the edges being made 10 inches thick. However, the entire slab can be made 8 inches thick if it is impossible for truck wheels to get on the edge of the slab. This is usually the case when there are posts or curbs along the edge. For traffic consisting



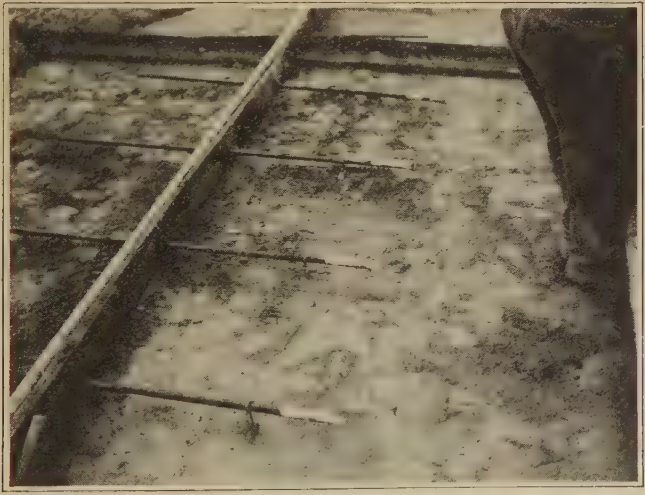
WHEEL LOAD "W"	d	t
Not to exceed 6000 Lb. per wheel.	8"	6½"
6000 to 8000 Lb. per wheel.	9"	7"
8000 to 10,000 Lb. per wheel.	10"	8"

Sections of typical concrete driveway as built by industrial concerns. These are designed for particular conditions and are not suited for every job

largely of 10-ton trucks, the edge thickness should be 11 inches and the remainder of the slab 9 inches in thickness.

Materials and Proportions

All materials should be clean and well graded. The best sand for pavement work contains particles ranging from grains that are quite small to those which will just pass a ⅜-inch screen. Coarse aggregate should be graded from particles ¼ inch in diameter to those having a diameter of about 2½ inches. Sometimes a maximum size of 1½ inches is desirable. Crushed rock and stone or pebbles are satisfactory, but "pit run" gravel or mixed aggregate is undesirable.



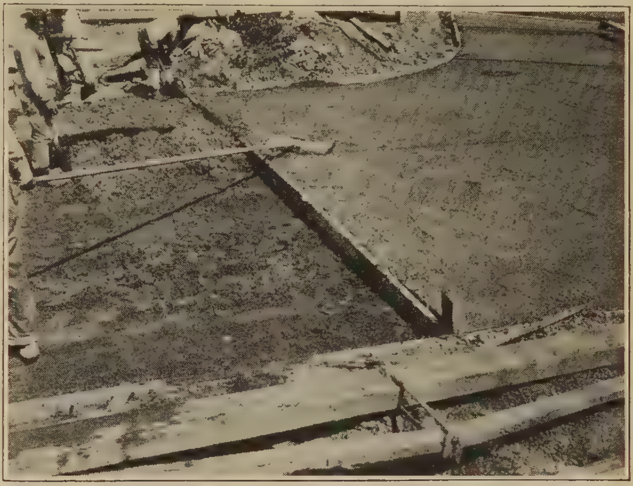
Dowels in concrete pavement are capped with tin to provide space at ends for pavement when expansion and contraction occur in pavement

Concrete of the same proportions should be used from the bottom to top of slab. Common proportions range from 1:1½:3 mixture, meaning one sack of cement to 1½ cu. ft. of sand to 3 cu. ft. of coarse aggregate, to the 1:2:4 mix. Of these, the 1:2:3½ is the most common and is recommended.

Just enough water is used so the concrete can be placed without honeycomb spots and finished without rock pockets in the surface. When finishing very little water should come to the surface. Additional water only weakens the concrete.

High Early Strength Concrete

It is often necessary to open an industrial driveway to traffic sooner than the 10 to 14 days usually given concrete to harden properly. In this case high early strength concrete is frequently used. Higher strength may be obtained by using more cement (say a 1:1½:3 mix), a smaller quantity of mixing water (say 4½ gallons to the sack of cement) and a mixing time of from 3 to 5 minutes. Such concrete could be opened to traffic in 3 or 4 days during warm weather. While ordinary concrete could be opened to automobiles in 3 or 4 days during warm weather, truck traffic should be excluded for the regulation 10 to 14 days. Some high early strength cements are also available which will permit early opening of pavements with standard proportions.



Joint header in place for transverse joint on concrete driveway

Reinforcement

Reinforcement, weighing from 35 to 45 pounds per 100 sq. ft., should be laid 2 inches below the surface of the concrete with the heavier wires in the direction of the greatest length of slab. Edges of mats or bars should be lapped several inches. Reinforcement should not run across transverse joints.

Preparing Subgrade

In general, the rule for subgrade is that the soil on which concrete slabs are placed should support them uniformly. Information given in the article, "How to Build Filling Station Driveways," published in the July, 1929, issue, should be followed for industrial driveway work.

Joints and Curbs

It is important that concrete driveways for industrial traffic be divided into blocks not more than 15 feet wide and not more than 30 feet long. Expansion joints of premolded joint filler should be used between the pavement and all rigid structures. In short driveways, joints dividing the slab into blocks may be formed by using a "T" bar. The web is pushed into the partly finished concrete, forming a slot from 2 to 3 inches deep and ¼ to ½ inch wide in the surface of the slab. Long driveways require true expansion joints across the slab. About 1 inch of expansion space is required for each 100 lineal feet of driveway. The edge of the slab along all joints should be rounded with an edger having a radius of ½ inch. Under no circumstances should any concrete, even though it is only an eighth of an inch thick, be left on top of the joint material.

Concrete curbs are best built as integral parts of the driveway, according to instructions given in the article, "How to Build Filling Station Driveways." It is important that all joints in the slab should extend through the curbs.

Forms

Form work, of course, varies with each particular job, and the concrete builder will be able to design the forms with comparatively little difficulty. It is important that forms be firmly bedded on the undisturbed earth, if possible, or on well compacted earth, so that they will retain the proper grade during construction. They should also be well staked so that the pressure of the concrete will not move them.

Mixing and Placing

A batch mixer is best adapted for the smaller industrial driveway jobs, and the concrete should be mixed for at least one minute.

Concrete should be placed continuously with one batch following another. If the mixer is stopped for 30 minutes or more, a bulkhead must be put in to form a square butt joint. When the mixer is stopped for not longer than 20 minutes, the new concrete should be mixed into the edge of the old by slicing or shoveling them together. Spading along the forms is always necessary.

Because the entire job is judged by the appearance of the finished driveway, the surface should be made true and even, free from rock pockets or other blemishes, and the corners at the edges of the slab should be rounded. The first finishing operation is striking off the surface. Then the surface is smoothed by a board float. The final finish is imparted by a canvas or board float. As too much finishing is detrimental, finishing should stop just as soon as the desired surface is obtained.

Curing Concrete Pavements

To avoid shrinkage and loss of strength, the concrete should be covered with wet burlap just as soon as the surface is hard enough to prevent damage. The burlap is then kept constantly wet until the pavement is opened to vehicles. The burlap may be replaced by a 2-inch layer of hay or straw.

Although this article gives only the high points of concrete driveway construction, concrete builders can obtain detailed information by referring to the July, 1929, issue in which is published the article, "How to Build Filling Station Driveways." Of course, each industrial driveway project has different conditions and the concrete builder will have to be governed accordingly. Good rules to follow are these:

On large jobs, adhere strictly to the specifications submitted by the construction department or the engineer representing the buyer; on small jobs, where the concrete builder is responsible for design, specifications and construction, it is well to consult an experienced engineer or builder of concrete pavements when there is any doubt about slab thickness, placing of expansion joints, etc.

Conferences in January for Contractors in South and East

Concrete builders in Indiana, New York, New Jersey, Kentucky, Tennessee, Ohio, Alabama, Georgia, South Carolina and North Carolina will have an opportunity to discuss plans for the future when they meet during January at conferences arranged in these states by the Portland Cement Association. All contractors who do monolithic concrete work exclusive of pavements or large reinforced concrete structures where engineering design is required are invited to attend these conferences, the schedule of which follows.

In conducting these meetings, the Portland Cement Association is continuing its co-operation with concrete contractors to help these men enlarge their present markets and develop new ones. Each meeting will be in charge of an association representative who is prepared to discuss the problems and plans of concrete contractors.

Indiana

Evansville, Jan. 6, McCurdy Hotel.
South Bend, Jan. 6, LaSalle Hotel.
Fort Wayne, Jan. 8, Chamber of Commerce.
Indianapolis, Jan. 10, Chamber of Commerce.

New York

White Plains, Jan. 7, City Hall.
Jamaica, Long Island, Jan. 10, Eagle Palace.
St. George, Jan. 14, Staten Island Masonic Club.

New Jersey

Hackensack, Jan. 17, Carpenters' Hall.
Newark, Jan. 21, Clinton Hill Masonic Temple.
New Brunswick, Jan. 24, Elks Club.
Trenton, Jan. 27, Architects' Exhibit Building.
Camden, Jan. 29, Walt Whitman Hotel.
Atlantic City, Jan. 31, Ambassador Hotel.

Kentucky

Louisville, Jan. 8, Seelbach Hotel.

Tennessee

Nashville, Jan. 10, Andrew Jackson Hotel.
Chattanooga, Jan. 13, Chamber of Commerce Building.

Ohio

Columbus, Jan. 14, Builders' Exchange.
Cincinnati, Jan. 17, Building Industries Building.
Dayton, Jan. 20, Builders' Exchange.
Toledo, Jan. 23, Waldorf Hotel.
Cleveland, Jan. 27, Hollenden Hotel.
Akron, Jan. 29, Builders' Exchange.
Youngstown, Jan. 31, Builders' Exchange.

Alabama

Birmingham, Jan. 16, City Hall.

Georgia

Atlanta, Jan. 20, Chamber of Commerce.
Macon, Jan. 22, Chamber of Commerce.
Savannah, Jan. 24, Morning News Town Hall.

South Carolina

Columbia, Jan. 27†, Chamber of Commerce.

North Carolina

Charlotte, Jan. 29†, Chamber of Commerce.
Greensboro, Jan. 31†, City Hall.

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†Meetings at Columbia, Charlotte and Greensboro will be held at 2:30 o'clock in the afternoon; all other meetings in January at 7:30 o'clock in the evening.

IN FUTURE ISSUES

Sidewalk and tennis court construction are two other types of work that will be described in forthcoming issues.

How to Build Curb Returns

Helpful Design and Construction Information for Builders of Concrete Driveways

BUILDERS of concrete driveways on residential property have learned to give careful consideration to the design and construction of curb returns.

The function of the curb return, as the approach from the street to the driveway is called, is to provide easy passage for vehicles. Therefore, experienced driveway builders are making every effort to build curb returns wide enough and with sufficient flare so that vehicles will not have to encroach upon the left side of the street and then turn sharply to the right when entering the driveway. When the curves of the curb return are too sharp, automobiles must swing onto the left side of narrow streets if they are to enter the driveway, and on wide streets they must cut across other traffic moving in the same direction. In each case there is danger of collision.

Width of Opening

The length of the automobiles which use the driveway most of the time, the width of the street and the width of the parkway are factors which determine what opening is required at the curb line. For example, a vehicle having a long wheelbase will require a fairly wide opening at the curb in order to turn into the driveway without approaching it from the farther side of the street. Likewise, a wide parkway on a narrow street will require a greater opening at the curb line than a narrow parkway. The width of the street also has an influence on the amount of curb opening required as a narrow street considerably reduces the turning space if the vehicle is to remain on the right side and avoid encroaching on the lanes used by traffic coming from the opposite direction.

Length of Curve Radii

To assist builders of concrete driveways in choosing the proper design for curb returns, the accompanying table, which gives dimensions for various typical conditions, has been developed. This has been worked out assuming that few, if any, cars have a minimum turning radius for the inside wheels of more than 22 feet. That is, any car which can turn in a circle having a radius of 22 feet or less may conveniently use curb returns built according to data given in the table.

In general, there are four ways in which curb returns can be designed or laid out. Three of these, with typical sections, are shown in accompanying illustrations. The fourth type, which is adapted for use only on very wide frontages along the street or roadway, is very seldom used on city property. This design is known as the "Y" intersection in which a separate driveway curves right and left to an intersection with the street or road. Although this design provides easy passage in either direction, it occupies too much space for average city property.

Type "A" Curb Return

One of the most common types of curb return is illustrated in Fig. 1. This return, called Type "A" here, has a short flare at the curb line, the radius of which is measured from a point in the parkway. In most cases a radius

TABULATION OF RADII TO PRODUCE REQUIRED CURB OPENING FOR VARIOUS STREET AND PARKWAY WIDTHS

		Width of Driveway					
		8 Feet		9 Feet		10 Feet	
Width of Street Between Curbs (Feet)	Width of Parkway Measured From Sidewalk to Street Face of Curbs (Feet)	Radius of Edge of of Return (Feet)	Width of Driveway Opening at Curb Line (Feet)	Radius of Edge of Curb Return (Feet)	Width of Driveway Opening at Curb Line (Feet)	Radius of Edge of Curb Return (Feet)	Width of Driveway Opening at Curb Line (Feet)
24	4	10*	20	11*	19	12*	19
	6	14*	19½	15*	19	(6)	(22)
	8	(8)	(24)	(8)	(25)	10	18½
	10	12	19½	13	18½	15	18½
	12	16	20	17	19½	21	18½
	14	21	19½	23	19	28	18½
28	4	(4)	(16)	5	13	(2)	(14)
	6	8	14	11	13	(2)	(14)
	8	14	13½	11	16	(2)	(14)
	10	20	14	28	13	(2)	(14)
	12	28	14	40	13	(2)	(14)
	14	40	14	50	13	(2)	(14)
30	4	5	12½	(2)	(13)	(2)	(14)
	6	12	11½	(2)	(13)	(2)	(14)
	8	24	11	(2)	(13)	(2)	(14)
	10	30	12	(2)	(13)	(2)	(14)
	12	46	12	(2)	(13)	(2)	(14)
	14	(4)	(16)	(2)	(13)	(2)	(14)
32 to 40	4 to 14	(2)	(12)	(2)	(13)	(2)	(14)

( ) Radius measured from point in parkway—Type "A."
* Radius measured from point on edge of sidewalk nearest the property line—Type "C."
Radius of all others measured from point on edge of sidewalk nearest the street—Type "B."

of 2 or 4 feet will be found sufficient to produce an opening of adequate width. This type of curb return is best adapted for use on streets which are 28 feet or more in width depending upon the width of the driveway being constructed. In building any curb return, there are various fixed dimensions—the width of the street, the parkway width, the sidewalk width and, where the driveway is already built, the width of the pavement in the drive. In Fig. 1, for example, the street is 30 feet wide, the parkway 14 feet wide, the sidewalk 5 feet and the driveway is 8 feet wide. Referring to the table, it is found that an opening of 16 feet is required at the curb line to permit a car to enter without encroaching upon the left side of the street. Likewise, a radius of 4 feet will give the curve required for the curb return. With narrower parkways and all other conditions being equal, the curb return can be built according to the design shown in Fig. 2. This is known here as Type "B" and is discussed in detail.

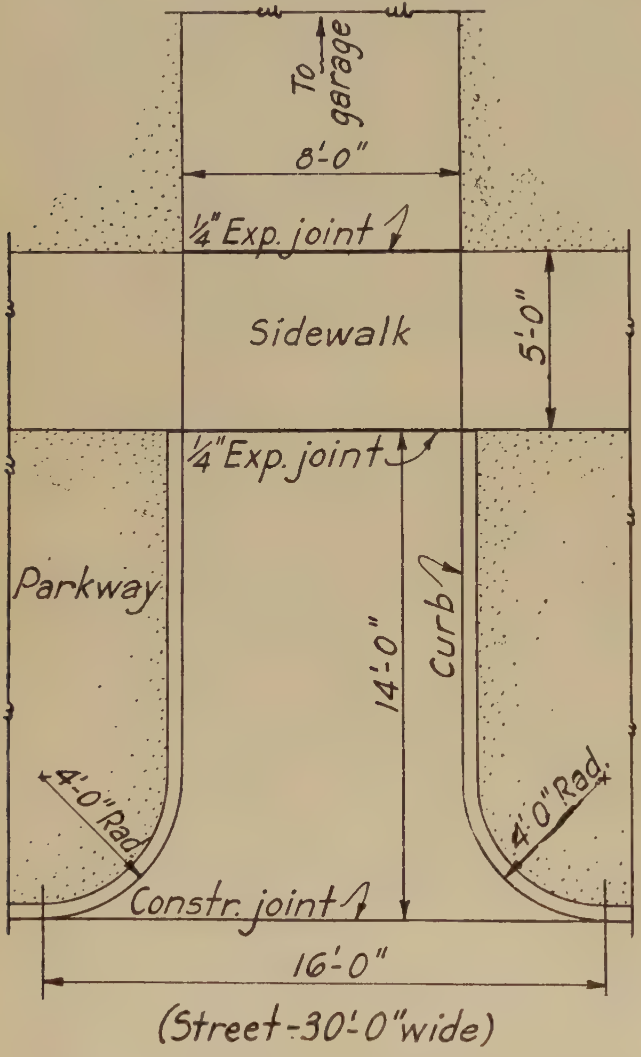


Fig. 1. Concrete curb return for private driveway. In this, Type "A," the radius is measured from a point in the parkway. See table for other conditions where this type is suitable

Type "B" Curb Return

Another common type of curb return, known here as Type "B," is shown in Fig. 2. This type is designed with a continuous flare throughout the width of the parkway, the radius being measured from a point along the edge of the sidewalk nearest the street. The fixed dimensions in this diagram are: street width, 24 feet; parkway width, 10 feet; sidewalk width, 5 feet; driveway width, 8 feet. The table shows that a curb opening of 19 feet 6 inches will be required and that the curb shall have a radius of 12 feet, measured from a point on the edge of the sidewalk nearest the street. In using this design a short radius, usually about 2 feet, should be used at the point where the curb return meets the street curb. This will round off the edges of the curb at this point.

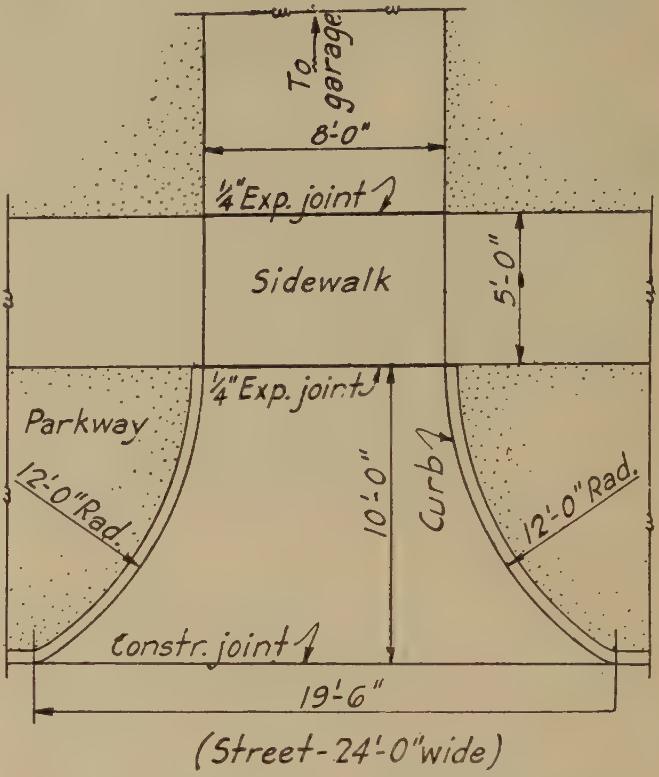


Fig. 2. Type "B" curb return, with radius measured from point along edge of sidewalk nearest street. For other conditions of this type see table

Type "C" Curb Return

This type is similar to Type "B" except that the radius of the curb return is measured from a point along the edge of the sidewalk nearest the property. Designing the curb return in this manner produces several feet more of curb return width at the street edge of the walk. Therefore, this type is best suited for narrow parkways on narrow

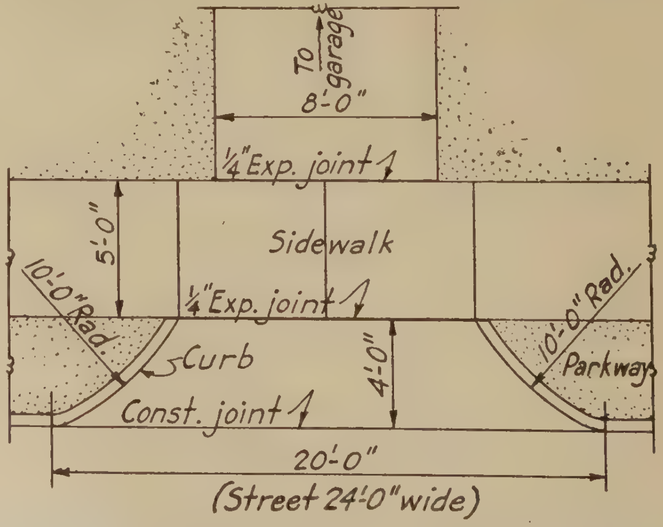


Fig. 3. In the Type "C" curb return shown here, the radius is measured from point along edge of sidewalk nearest the property. See table for other conditions of this type

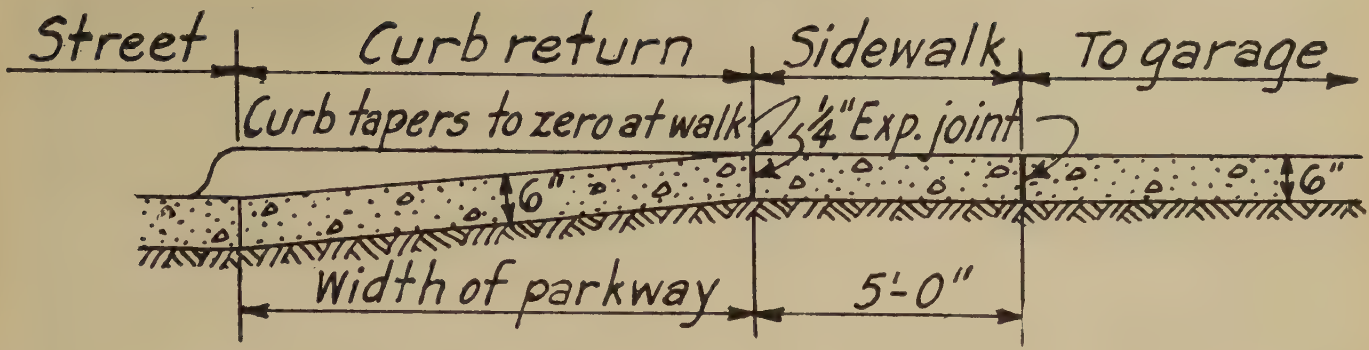


Fig. 4. Typical longitudinal section of curb return

streets. In the illustration, Fig. 3, the fixed dimensions are: street width, 24 feet; parkway width, 4 feet; sidewalk width, 5 feet; driveway width, 8 feet. According to the table, an opening of 20 feet is required at the curb line and the curb shall have a radius of 10 feet, measured from a point on the edge of the sidewalk nearest the property.

Driveway and Sidewalk Widths

In the accompanying illustrations, the sidewalk width in each case is 5 feet, a width that is considered as standard. Although all of the diagrams show drives that are 8 feet wide, this may not always be the case. However, the table gives curb openings and radii of curb returns for driveways that are 9 or 10 feet wide, enabling the driveway builder to meet almost any conditions.

For streets wider than 30 feet, the Type "A" curb return is best adapted, as is shown in the table. And, for a 28-foot street, the "A" type is best suited when the driveway is 10 feet or more wide.

In selecting the type of curb return for any conditions, consideration should be given to the width of the opening at the curb line. First of all, this opening should only be sufficient for easy passage of vehicles to and from the street. Excessively wide openings will often cause undue interruption in the spacing of trees in parkways and the removal of from one-half to two-thirds of the street curbing in a block. In most cases, curb returns have openings of from 12 to 14 feet, as indicated in the table, and these widths will ordinarily be sufficient. In some cases, however, where there is a combination of factors such as a vehicle having a long wheelbase and wide parkways on narrow streets, a width of 18 to 20 feet may be necessary.

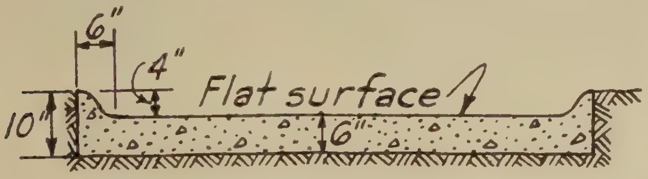


Fig. 5. Typical cross section of curb return

Construction of curb returns, insofar as concrete mixtures, finishing and curing are concerned, is the same as for concrete driveways, the construction of which was discussed in an article in the November, 1929, issue.

The grade between the curb line and the sidewalk should be carefully planned so that the completed driveway will conform as much as possible with the surrounding ground and so that no excessively sharp breaks occur at the sidewalk. Figs. 4 and 5 show typical longitudinal and cross sections of a curb return. Where narrow parkways exist, sharp breaks in grade very often cannot be avoided in building the curb return flush with the sidewalk.

The convenience and service afforded by a well-designed and properly built curb return more than offset the time or thought required to determine the right type.

New Cities in California Are Built of Stucco

Within the past few years a number of new cities have been built in California. One of the most attractive is San Clemente, heralded as the "Unique Spanish Village."

This city was founded in December, 1925, and comprises two thousand acres of land with approximately five miles of ocean frontage.

The town is located on the Coast highway between Los Angeles and San Diego, approximately seven miles south of San Juan Capistrano.

How Wichita Obtains Good Sidewalks

Close Supervision and Licensing of Contractors Assures Quality Construction

By **P. L. BROCKWAY**
City Engineer, Wichita, Kansas

WICHITA, Kansas, is the center of a rapidly growing airplane industry and of a large oil development. Airplanes and oil have brought increased industrial activity, an important part of which is the construction of many thousand feet of new sidewalks, curbs and gutters as the city expands in area and new residence and commercial structures are erected.

The concrete sidewalks, curbs and gutters, Wichita, Kansas, shown above were built by contractors licensed by the city, under the plan described in the accompanying article

Work Closely Supervised

For almost twenty years, the city has exercised direct control over the construction of its public sidewalks, curbs and gutters. An ordinance, passed in 1910 and amended in 1915, places responsibility for this work squarely upon the city engineer, through the following provisions:

a. All public sidewalks, curbs and gutters must be of concrete.
b. The concrete must meet specifications of the city engineering department.
c. The contractors who do the work must obtain a license from the city.
d. All work must be inspected.
e. The city shall employ a concrete inspector.

The outstanding provisions assuring that the concrete work will be of high quality are the last three listed, requiring the licensing of concrete contractors, the inspection of all jobs and the employment of a concrete inspector. The ordinance was well-planned and is so designed as to be eminently fair to everybody concerned—the city, the contractor and the taxpayers.

Contractor Must Have License

Before bidding on sidewalk jobs, the contractor applies for a city license permitting him to engage in concrete contracting. To be eligible for a license, he must have competent workmen in charge of his construction forces and must show, to quote the ordinance, "that he is skilled in the art of constructing sidewalks, curbs and gutters." The applicant pays a fee of $7.50 for three months or $10.00 for six months. If desired, licenses for longer periods may be taken out, but there is no reduction in the fee of $10.00 for each six months.

December, January and February are not counted as part of the license period. For example, a six months' license taken out August 1 extends until the first of May, following. In this way the license is not an expense to the contractor during the winter months when work is likely to be dull.

Since permits must be obtained for the construction of new sidewalks, repair of old walks, or removal of existing walks and curbs for building driveways, the city engineer's office knows what work is going on and what contractors have the jobs. Of course, permits cannot be issued unless the contractor is licensed and is in good standing. When construction is under way, the contractor notifies the city engineer's office in ample time for the work to be inspected.

Inspection

The ordinance requires that inspection shall be made before the concrete has set, and one city inspector, whose employment is required by the ordinance, devotes his time exclusively to the inspection of concrete work. Every sidewalk, curb and gutter job is inspected and reports are made daily. If the work is satisfactory, it is accepted without question.

On the other hand, if the inspector finds that the concrete does not meet specifications, the city engineer refuses to accept it until the faulty work is reconstructed. Furthermore, the contractor cannot obtain permits for other work until the error is corrected, and the contractor is liable, not only to revocation of his license, but also to arrest and fine if his offenses are frequent or flagrant.

While the penalty may sound somewhat severe, these provisions form the "teeth" in the ordinance that assure good concrete work. In practice, it has been found that the majority of the contractors endeavor to do a good job in the first place and that a contractor would far rather replace faulty concrete than forfeit his right to engage in further construction.

In the event that the contractor has had his license revoked, he may apply for reinstatement on the same terms as it was originally issued. A contractor who has once lost his license is always careful not to endanger himself a second time.

The three interested parties to this system—the city, the contractors and the taxpayers—are all provided protection and are receiving the benefits of these measures. From the standpoint of the city engineer the ordinance has proved entirely successful. The writer has been in the department since the passage of the original ordinance and his experience has led him to favor it strongly. It gives the city engineer power to keep irresponsible or dishonest contractors off the public streets. It is worth a great deal more to the taxpayers than the cost of administration and enforcement.

License Benefits Contractor

During the first two or three years that this ordinance was in effect, some of the concrete contractors felt that undue discrimination was directed against them and voiced some objections. However, when they realized that it worked to their protection, the system became accepted as ordinary routine and in fact, the responsible contractors are heartily in favor of the licensing method. Occasionally, when outside contractors first come to Wichita, they object to the license, but as soon as they have worked under its protection, they come to favor it. Approximately 60 concrete contractors are licensed at present.

That the citizens appreciate the protection provided by this ordinance is indicated by the fact that many owners have asked for engineering control and inspection of concrete work on their own lots. Unfortunately, the engineering department has neither the authority nor the organization to comply with such requests.

The effect of the licensing system, however, has been to raise the standard of private as well as public concrete work. Owners prefer to employ licensed contractors for private work, knowing that these men must be capable of doing quality concrete construction in order to obtain their licenses. Thus the possession of a license establishes a reputation for the contractor, which he must maintain. In this way the standards for concrete foundations, driveways, steps and floors have been raised by the ordinance although it covers only public sidewalks, curbs and gutters. Sidewalks, curbs and gutters constructed under direct contract with the city have the same inspection supervision as pavement, sewers or other public works.

The working of the ordinance, as described, applies to work done under private contract between individual citizens and various contractors. Other construction groups have been similarly licensed. Among these are plumbers, electricians, sign hangers and house movers.

Selling Industrial Driveways

(Continued from Page 43)

first cost and does not require frequent and expensive maintenance."

When the concrete builder proved that concrete satisfies all these essentials of the ideal driveway surface, the superintendent ordered concrete industrial pavements. Plant managers and superintendents who have had concrete driveways built are boosters for concrete, and aggressive concrete builders are using their recommendations and testimonials in getting more business of this kind.

Some of the sales points used regularly by builders of concrete driveways are as follows: In large plants throughout the country concrete has been chosen as the material best suited to meet the requirements of industrial traffic. A good pavement will amply repay its cost in greater efficiency, through easy access to and from the factory and in reduced hauling costs. A rigid concrete driveway, with its uniformly even surface, is a lasting improvement. In great manufacturing plants, where dependable service is demanded, concrete is regarded as the logical pavement to build.

Sales to Docks and Wharves

That concrete builders have been selling their services to those in charge of construction for docks and wharves is evidenced by the fact that every day thousands of tons of freight rumble over the concrete-decked docks in the ports of the United States. For example, the City of New York built a concrete pavement upon the Canal Street dock, Staten Island, in 1906. Today, after many years of hard service, the concrete pavement shows but little effect of the regular, heavy, steel-tired traffic to which it has been subjected. Repairs have been reduced to a minimum. Drays and trucks are used to move thousands of tons over the surface every time a freighter docks.

Concrete Pavements for Railroads

Some of the important railway uses of concrete are for team tracks, freight yard pavements, driveways between buildings, around passenger stations and through train sheds. Progressive concrete builders are rapidly developing business among these railroads because there is a good market for concrete pavement work.

Builders can use the following example as a sales point: Several years ago engineers of the Santa Fe Railroad made tests which proved the economy of concrete pavements. They found that it required less draw or pull to start a truck load of material on concrete than on any other kind of pavement. The engineers also determined it required less steady pull to keep a load moving, as compared with other types of paved surfaces. As a result, the Santa Fe has since been a consistent user of concrete, as have the other great railroads of the country. Thousands of square yards of concrete were used in paving the great Santa Fe fruit terminal at Chicago.

Probably one of the most important sales points available for the aggressive builder's use is the fact that paved yards and driveways are a great incentive to orderliness.

Modern Stucco and Plaster

A Discussion of Standard Practice in Application of Portland Cement Stucco and Plaster

Proportions, Application to Various Types of Surfaces, and Painting of Plaster

(Installment VI)

(Editor's Note: This article concludes the series on the latest developments in approved plastering practice.)

THERE is no adequate substitute for portland cement plaster as an interior finish wherever walls, partitions and ceilings are subject to rough usage or extreme moisture conditions. It is used in basements, steam rooms, vapor baths, toilet rooms, swimming pools, garages, storerooms, trucking alleys, elevator shafts and in other places subjected to hard service.

Specifications for cement, grading and testing of aggregates, use of plasticity agents, water requirements, and the use of mineral pigments and colored cement for portland cement plaster are the same as for portland cement stucco. (These were given in Installment I of this series.) Hair or fiber used in scratch coat mortar on metal lath or wire lath should consist of first quality long hair free from foreign matter, long fiber well combed out, or a combination of both.

Proportions of materials for portland cement plaster and directions for mixing are exactly the same as for portland cement stucco, as described in Installment I. For scratch coat mortar or metal lath or wire lath, hair or fiber is added. Usually 1/5 of a bushel per sack of cement is sufficient. In no case should more than ⅓ of a bushel per sack be used.

Portland cement plaster may be applied to masonry, monolithic concrete and metal lath or wire lath bases. The application of the scratch coat differs for each type of base, but the brown and finish coats are applied in exactly the same manner regardless of the type of base.

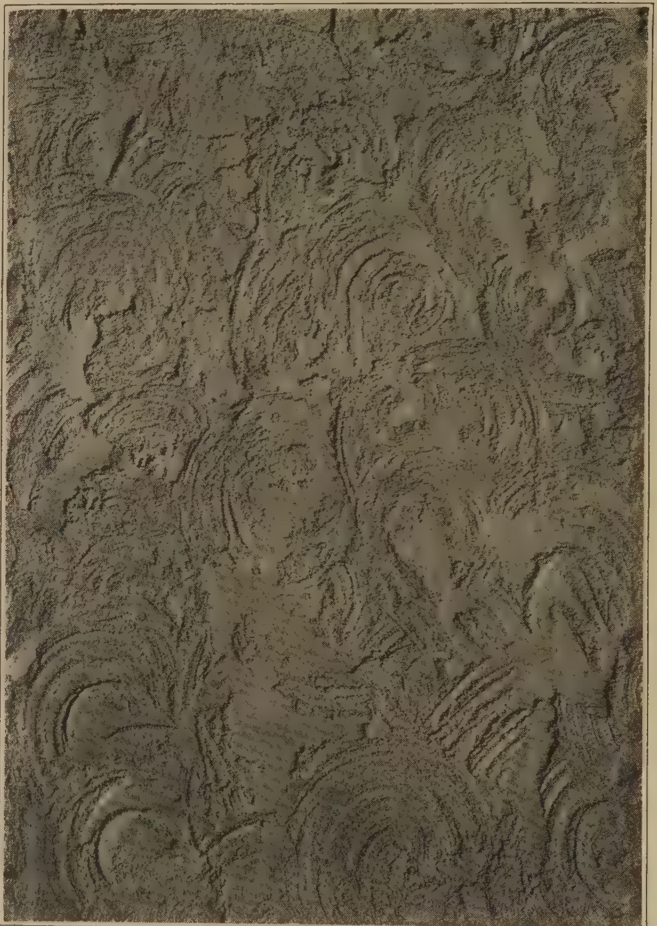
Masonry. Concrete and clay masonry partitions and ceilings are excellent bases for the direct application of portland cement plaster. Concrete and clay furring tile and exterior masonry walls which may not require furring because they possess high insulation value are also plastered direct.

All masonry units to which plaster is applied direct should have faces sufficiently rough to provide mechanical key. Portland cement mortar should always be used in laying up masonry walls that are to receive portland cement plaster. Joints may be raked or struck off flush. The surfaces should be cleaned to remove all dust, dirt, soot, oil, paint or any other material that might interfere with satisfactory bond.

Monolithic Concrete. Monolithic concrete walls and ceilings that have coarse or roughened surfaces are suitable bases for the direct application of portland cement plaster. When monolithic surfaces are not sufficiently rough or coarse to provide mechanical key for the first coat it is necessary to prepare them in one of the ways described for portland cement stucco in Installment II.

Metal Lath or Wire Lath. Metal lath or wire lath should be used as a base for portland cement plaster applied on stud partitions, furred or suspended ceilings, wall board or plaster board, gypsum furring tile and such masonry or monolithic concrete walls as require furring out with strips. Gypsum furring tile should be covered with waterproof building paper before the lath is applied.

Lath that will readily embed in the plaster is desirable and for this reason should consist of strands of wire (wire lath) or narrow strips of metal (expanded metal lath).


The sponge swirl, a texture suitable for interior work. A troweled coat is "knocked down" with swirling motions of a sponge. Then high lights are developed by running a trowel over the surface

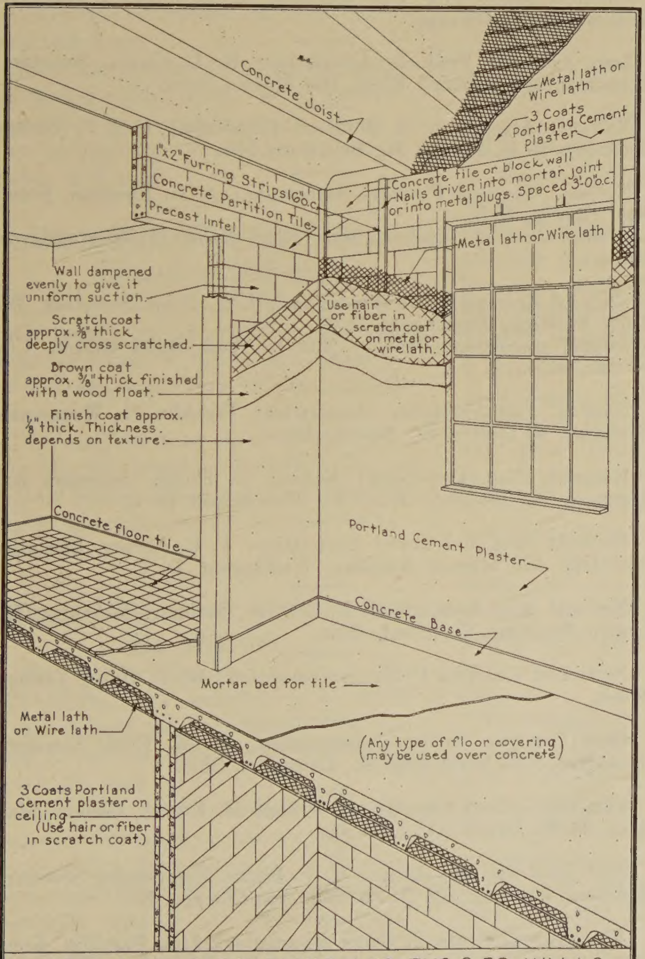
The lath must have sufficient weight to provide a rigid plastering surface between supports. Supports should not be spaced at greater than 16-inch intervals. Where studs or joists are placed more than 16 inches apart, furring channels or other supports are required. For the maximum spacing of 16 inches, lath weighing 3.4 pounds per square yard will give the required rigidity. Two and one-half pound lath for walls and 3-pound lath for ceilings is often specified where supports are only 12 inches apart, although many plastering contractors in the interest of keeping fewer stocks on hand use but one weight —3.4 pound—which satisfies the requirements of different spacings up to the maximum of 16 inches. The lath should be painted, galvanized or otherwise protected against possible corrosion.

Lath may be attached directly to the faces of structural members that are less than 4 inches wide. On all faces wider than 4 inches, the lath should be furred out to permit the formation of plaster keys behind the metal. Furring strips may be wood or metal and should be securely fastened to the wall. If of metal, clearance should be provided between the wall and the strip to permit attachment of lath.

To provide a continuous network of metal over the entire area, overlapping sheets must be laced securely with galvanized wire. Sheets should be lapped at least one inch on sides and ends, and fastened on 6-inch centers to every support they cross. Annealed galvanized wire, usually of No. 18 gauge, is used to fasten the lath to metal supports and 6-penny nails or 1¼-inch staples are used on wood supports.

Application

Suction is absolutely necessary in masonry and monolithic concrete bases and in each coat of portland cement plaster. For an understanding of suction and the methods of securing it, refer to Installment III. Suction is kept uniform more easily on interior work than on exterior work, but this fact should not cause the plasterer to give less attention to its proper control when applying portland cement plaster.


Concrete Joist
Metal lath or Wire lath
3 Coats Portland Cement plaster
1"x2" Furring Strips 16" o.c.
Concrete Partition Tile
Precast lintel
Concrete tile or block wall
Nails driven into mortar joint or into metal plugs. Spaced 3'-0" o.c.
Metal lath or Wire lath
Wall dampened evenly to give it uniform suction.
Scratch coat approx. ⅜" thick deeply cross scratched.
Use hair or fiber in scratch coat on metal or wire lath.
Brown coat approx. ⅜" thick finished with a wood float.
⅛" Finish coat approx. ⅛" thick. Thickness depends on texture.
Concrete floor tile
Portland Cement Plaster
Concrete Base
Mortar bed for tile
Metal lath or Wire lath
(Any type of floor covering may be used over concrete)
3 Coats Portland Cement plaster on ceiling (Use hair or fiber in scratch coat.)

CEILINGS. PARTITIONS AND FURRED WALLS

The Scratch Coat. Portland cement plaster on masonry walls and ceilings is applied in the same manner as portland cement stucco on masonry walls. Refer to Installment III.

The scratch coat on monolithic concrete walls is applied in the same manner as the scratch coat of portland cement stucco on such walls. It is dashed on, or if the wall is sufficiently rough, may be troweled on. See Installment III. In order to secure tight bond on monolithic concrete ceilings, portland cement plaster should always be dashed on.

On metal lath or wire lath, the scratch coat mortar is spread with the trowel, using relatively light pressure. The hair or fiber in the mortar aids in the formation of plaster keys, holding the mortar in place.

The Second or "Brown" Coat. The brown coat of portland cement plaster is applied in exactly the same manner as the brown coat of portland cement stucco. See Installment III. Grounds sometimes are used as they aid in building up uniform thickness.

The Finish Coat. The brown coat must be cured and dried as described under "Curing," before the finish coat is applied. The usual finish on interior portland cement plaster is either a sand float or a texture of low relief similar to the one shown in the accompanying photograph.

If a smooth troweled finish is desired, late troweling is required. The steel trowel forces sand particles down into the plaster, compacting the mass and leaving the surface smooth. Moist curing for at least 7 days is recommended to avoid checking, particularly on hard troweled finishes.

Since portland cement plaster is generally exposed to severe conditions of usage, it should be given every opportunity to develop its maximum strength and density through proper curing. Methods of curing portland cement stucco as described in Installment III apply equally to portland cement plaster and should be followed carefully. Interior plaster usually dries more slowly than stucco, consequently additional time must be allowed for complete drying after the curing period. Thorough drying of each coat before applying another is absolutely essential as it guards against objectionable checking in the finished job.

Portland cement plaster should be protected against freezing during the hardening period. In enclosed buildings there is little danger of freezing, except in the most severe weather, in which case artificial heat is desirable.

Artificial heat may be required to accelerate drying in closed buildings. In such cases a temperature of 70 degrees Fahrenheit with gentle circulation of air will produce desired results. The plaster is likely to dry too quickly if higher temperatures are maintained.

Painting

Portland cement plaster may be painted with either oil or water paints. If water paint is to be used, manufacturers' instructions should be followed.

If oil paint is to be used the surface should be allowed to dry thoroughly. Then it should be covered with a solution of zinc sulphate mixed in the proportions of 2 or 3 pounds of crystals to a gallon of water. The surface then must be allowed to dry 48 hours, after which any remaining zinc sulphate crystals are brushed off. Under no condition should the solution be applied before the wall is completely dry. After the application of the zinc sulphate wash, the walls should be sized with oil or varnish, after which the surface is ready for oil paint or other decorative finish.

The Concrete Industry —25 YEARS AGO

THREE pages are devoted to an article entitled "Materials Which Retard the Setting of Portland Cement," by R. C. Carpenter in the January, 1905, issue of CONCRETE. The conclusion drawn is "that chloride of calcium added in small percentages either to the ground clinker as a powder or mixed with the water for gauging, has an important effect in extending the time of setting of portland cement, and so far as the investigations which are accessible show, it does not have any detrimental effect on the permanent strength and hardness."

THE most interesting reports at the annual meeting of the American Portland Cement Manufacturers in December, 1905, were reports from the committees on "uniform specifications," "steel concrete," and "new uses." "The result of the reports of these committees is a report embodying a set of uniform specifications and methods of testings, which have been approved by the association interested in the subject."

TWENTY-FIVE years ago construction of the Panama Canal was about to begin and CONCRETE reports that "The preliminary work of the Canal has been very thoroughly and economically accomplished and the Panama Canal Commission appointed by President Roosevelt has assumed control of the new territory and begun active operations. . . . Considerable excavation has been completed."

DESCRIBING the construction of a silo at South Lyon, Mich., CONCRETE stated, "A solid concrete foundation was first laid, then 2 by 2 studding were set up in the form of a circle. This was then lathed on both the inside and out with long strips of elm which were easily bent in a circular form. Grout concrete 1:6 was filled in between the lathing as the work of construction progressed. It was then plastered outside and in with a stronger mixture of 1:2 so that as it now stands it is a solid wall of concrete and wood about 4 in. thick."

THOSE who were readers of *Cement Age* a quarter-century back may recall the interest in the early reinforced concrete factory construction. The inquiries of a well-known eastern insurance expert prompted the editor to bring forth the publication of an article by George Maurice, C. E. of New York, summarizing a mass of data relative to the comparative cost of concrete and wood construction. Another article on the same subject tells of the floors of the full-bay type in a six-story and basement manufacturing building, of reinforced cinder concrete, 6 in. thick. "Three panels of the floor were erected, and while it was, of course, very far from its final strength, the center bay was tested with a load of sand to the extent of 290 lbs. per sq. ft. This was left for twenty-four hours. During the night a driving rain fell on the sand and while there were no means of measuring the increased weight, it was estimated that the load must have increased at least 50 per cent, the total deflection under this combination of unfavorable conditions being less than 3/8 of an inch."

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.

Annual convention, February 11th, 12th and 13th, Roosevelt Hotel, New Orleans, La.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth St., New York City.

American Road Builders' Association; Miss E. A. Birchland, Secretary, 29 W. Thirty-ninth St., New York City.

Twenty-seventh annual convention and road show, January 11th to 18th, 1930. Atlantic City, New Jersey.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.

Cast Stone Institute; Frank M. Brooks, Secretary, P. O. Box 417, Pasadena, Calif.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Iowa Concrete Products Association; R. L. Gavin, Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.

National Association of Builders' Exchanges; Earl F. Stokes, Secretary, 15 E. Fayette St., Baltimore, Md.

National Concrete Products Association; A. G. Swanson, Secretary, Omaha, Nebr.

Annual meeting, February 10th, Hotel Roosevelt, New Orleans, La.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

Annual convention, January 20th to 22nd, Hotel Gibson, Cincinnati, Ohio.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N.W., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; W. P. Hews, Yakima, Wash.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 3115 Plankinton Arcade, Milwaukee, Wisconsin. Annual meeting, January 29th and 30th, Milwaukee.

AT THE ROAD SHOW

To Be Held January 11th to 18th, at the Auditorium, Atlantic City, New Jersey

BULK CEMENT PROPORTIONING UNIT ON DISPLAY

In addition to the regular trailer weighing Agrabatcher plant, the Heltzel Steel Form and Iron Company, Warren, Ohio, will display a similar unit for the handling of bulk cement by weight. Through a novel arrangement, Heltzel has produced a cement storage bin said to be dustless, to which is attached its new cement weighing Agrabatcher, equipped with the dial scale and designed for accuracy in the proportioning of cement for any required mix. The flow of cement is controlled by valves.

The standard line of steel form equipment will also be exhibited.

Two New Koehring Products at Road Show

Koehring Company, Milwaukee, Wisconsin, will include two new products, the Dumptor and the 401 Shovel, in its exhibit at the Road Show in Atlantic City, N. J., January 13-18.

With full multiplane traction for mobility and easy handling over most any kind of ground, with the ruggedness and liberal drawbar power of a tractor, and with the bull dozing advantage of the dump body in discharge position, the Dumptor is described as a heavy duty unit embodying the features of truck, tractor and bull dozer.

Heavy duty shovel has a one yard dipper on 16 foot dipper sticks. When built as a crane, it has a capacity of 13 tons at 12 foot radius with a 50 per cent safety factor, it is said.

Link-Belt Will Exhibit a Crawler Shovel

Link-Belt Company, of Chicago, will exhibit their 1 cu. yd. capacity, type K-30, gasoline shovel at the annual convention of the American Road Builders Association.

The machine to be shown is representative of the complete Link-Belt line of crawler cranes, shovels and draglines, ranging in size from ¾ yd. to 2 cu. yd. capacity.

Mixer Bodies on Autocars to Be Shown

The Autocar Company, Ardmore Pa., will exhibit three important units at the National Road Show at Atlantic City, January 13 to 18 inclusive. They will occupy Booth No. 203.

One of the Autocar units will be a 5-ton, conventional type chassis on which is mounted a Transit mixer body of 3-3½ yards capacity. The Autocar chassis is especially suitable for carrying ready-mixed concrete bodies because of its strong frame construction and the reserve power of its 6-cylinder engine.

Another unit in the Autocar exhibit will be a 3½-ton, 6-cylinder Model SHS dump truck with a 114-inch wheelbase. This truck carries a 3½-yard Model H 225 A body, operated by the 600 Autocar rotary dump hoist mechanism.

Transit Mixers

Three or more new models of Transit mixers, embodying a number of improvements and refinements, will be shown at the road show by Transit Mixers, Inc., San Francisco.

Hopper and Bins To Be Seen in Butler Booth

The exhibit of the Butler Bin Company of Waukesha, Wisconsin, consists of a 40 cu. yd. contractor's bin divided into three compartments and equipped with the latest type weighing hopper. This hopper has been designed particularly to meet the demands for handling sand and two sizes of graded rock. It is equipped with a graduated three-beam scale, the hopper itself having three compartments to accommodate the three different sizes of aggregates. This bin may be moved from one setup to another as a unit without the necessity of removing the scales or weighing hopper and is so arranged that at a nominal expense solid rubber tired truck wheels and a frame on which the bin may rest can be added and the entire outfit hooked on to the rear of a truck to facilitate rapid and easy transportation, it is stated.

The balance of the exhibit will include a cement weighing hopper, a quick adjustable volumetric proportioning hopper, a small model of a V-40 cu. yd. two compartment bin carrying the latest type of volumetric proportioning hoppers, a small model of a weight proportioning hopper using removable weights, a roller gate and a duplex gate.

Chain Belt Equipment Display to Be One of Largest

Plans have been completed whereby the Chain Belt Company, Milwaukee, Wis., and its affiliated companies will present one of the largest exhibits of machinery and machinery parts ever displayed at the Road Show, according to an announcement.

The Construction Equipment division of the company will exhibit independently, and will display the latest models of Rex mixers, with all improvements which will be incorporated in the 1930 machines. The 1930 Rex 27-E Paver with important improvements will be shown for the first time. In addition the complete line of Rex pumps, including the diaphragm, the centrifugal, the road, and the plunger pumps, Rex plaster mixers, Rex saw rigs, and Rex contractors elevators will be shown.

27-E Paver, New 84-S Tilting Mixer, Features in T. L. Smith Exhibit

The T. L. Smith Company, Milwaukee, Wis., will feature in its exhibit the new 1930 model 27-E paver and the new 84-S 3-yd. Smith tilting mixer with Weigh-Mix equipment. In addition a two-bag 10-S Smith non-tilt mixer with skip Weigh-Mix and a 3½-S Smith tilter will be included. The Kwik-Mix line now manufactured by the Smith Company will be represented by a 3½-S and 5-S concrete mixer and a 5-PM plaster and mortar mixer.

Relay Truck at Road Show

The Good Roads show will mark the first public appearance of the new Relay truck model 50D, manufactured by Relay Motors Corporation at Lima, Ohio. This will be on display in Space 528 of the Exhibition Hall. The Relay Model S11 will also be on display. The 50D will be equipped with 3 yard dump body and hoist; the S11 with 1½ yard gravity dump body.

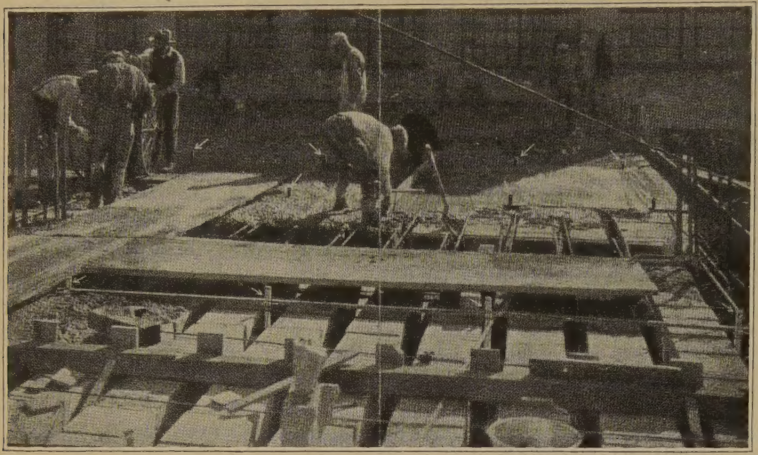
Steel and Wire Exhibit

The American Steel & Wire Company will occupy space No. 130 at the American Road Builders Show.

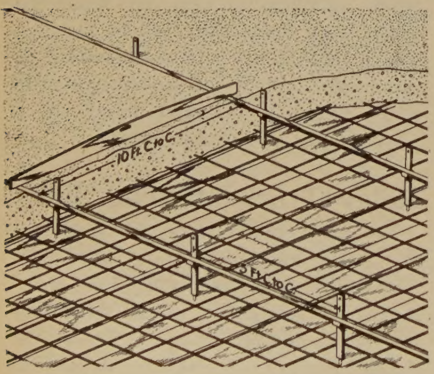
The exhibit will consist of concrete reinforcement fabrics, triangular mesh and electric weld for reinforcement of streets and highways.

New Equipment and Materials

Screed Gauges Simplify Concrete Slab Leveling



The M. & M. screed gauge is designed for leveling concrete slabs, requiring no special tools for placing, adjusting or removing, according to the manufacturer. All adjustments are made by a hammer. The gauges are driven into the form decking after boring a starting hole. The simple casting with a cut nail wedge is then immediately adjusted to the proper height. Adjustments may be made before or after they are set up. Absolute accuracy of the gauges can be obtained, it is said, by setting the gauges with an instrument. The gauges are driven from the top and are easily placed in line without interfering with the reinforcing steel.



When the gauges are set up for deep slabs it is advisable to brace them with a small gauge wire for side sway, or they may be wired to the reinforcing steel to steady them. They may be easily pulled out by hand if the slab is not too deep. A hook can be used through the hole in the top of the gauge for pulling them out of deep slabs.

Corrosion or concrete have no injurious effect on the gauges, so that they may be used over and over again, states the M. & M. Wire Clamp Company, Minneapolis, Minn.

Duromit New Floor Hardener

Duromit is heralded as the newest development in floor hardeners by the American Fluresit Company, Cincinnati, Ohio. The product may be used for hardening any concrete surface to the extent that it will be acid-proof, non-skid and guaranteed against checking or cracking.

Operations in the laying of floors with Duromit are similar to those used in ordinary concrete floor work. It is built up in three sections—the concrete base, the top coat and the Duromit layer. The Duromit hard-layer, mixed 1:1, is put upon the flooring layer immediately after the latter is in place. The mass is placed on the flooring layer, distributed uniformly while being pressed down. At the same time the surface is planed by the drawing of a lath over it. As soon as the Duromit layer has set sufficiently so that it is pliable, the surface is rubbed off with a wooden rubbing board and then with a steel smoothing trowel.

Industrial Literature

"Consolidated Contact" House Organ

The November issue of *"Consolidated Contact"* is the fifth issue of its house organ to be brought out by the *Consolidated Concrete Machinery Corporation,* Adrian, Mich. It contains a number of short items of interest, among them one telling how to cast cistern and cesspool block and another describing a new rock-face stripper.

International Talks About Aviation

Aviation and its progress is the chief subject of *Bulletin* 25 issued for November by the *International Cement Corporation,* New York City. The booklet covers air transportation developments in a brief way, being followed by five other short items of interest.

Pottsco Bulletin

The first of a series of printed circulars on *Pottsco* light-weight building back-up units appeared late in November. Each of the eleven outstanding features of the units is amplified in the circular. The latter will hereafter be published monthly by the *H. H. Potts Company,* Chicago.

Notes From the Field

Willard Form Specialties Now Nationally Distributed

J. M. Willard, president of the *J. M. Willard Co.,* of Los Angeles, has visited the East to arrange for the national distribution of the Willard form devices. Arrangements have been concluded with Fischer & Hayes of Chicago for a consolidation of their lines. The combined lines are now available throughout the United States through the 50 or more Fischer & Hayes distributors.

Former Wisconsin Traffic Engineer Joins Heil

The Heil Co., Milwaukee, Wis., announces the appointment of *C. N. Maurer,* formerly with the Wisconsin State Highway Commission for the past ten years, as director of the highway sales division of The Heil Co.

Mr. Maurer held the position of traffic engineer of the Highway Commission and formulated the new Wisconsin Traffic Code.

Milburn Manager

Charles P. Clampitt has been appointed by the *Alexander Milburn Company* to take charge of its Chicago office, 220 South State Street.